ANNUAL RATES OF SUBSCRIPTION.

Farmers, Graziers, Horticulturists, and Schools of Arts, **One Shilling.** Members of Agricultural Societies, **Five Shillings,** including postage. General Public, **Ten Shillings,** including postage.

VOL. XXXVIII 1 NOVEMBER, 1932. PART 5.

Event and Comment.

Town Lads for Land Jobs.

THE Senate of the University of Queensland has granted the Government the use of portions of the University lands at St. Lucia and Moggill for farm training for city boys. The Minister for Agriculture and Stock has expressed appreciation of the generosity and courtesy of the Senate of the University in making the land available. Already the Government had formulated a plan, he said, and would proceed to make the necessary alterations to put the scheme into operation early in the new year. An area up to eighty acres of good agricultural land suitable for cultivation was available, but he thought that area would be considerably in excess of the requirements for the scheme to train boys for the land. They would cultivate only sufficient for their needs. There was in addition a considerable area suitable for grazing purposes. It was not proposed to do any actual agricultural work at Moggill. Timber would be obtained from this area, and in this the boys would be instructed in methods of clearing, burning off, and making land suitable for ploughing. "Actually there will be two schemes put into operation on the area at St. Lucia, the use of which the Senate of the University of Queensland has granted to the Government for five years," said Mr. Bulcock. "One of these will be the training of boys for rural pursuits; the other the establishment of experimental agricultural plots."

In his 1931 report the Public Service Commissioner, Mr. J. D. Story, I.S.O., stated that one of the reductions which grieved him most was the reduction which almost closed the door of admission to the various sections of the State Service, and he observed that the closing of the Public Service avenues of employment had added greatly to the anxieties and difficulties of parents who have sons and daughters for whom to find employment. The rural industries had always interested him; consequently, the development of a type of education suitable for the rural industries had ever appealed to him. The initiating and launching of the rural school movement and the home project schemes were tangible evidence of his sympathy. Seeing that the door to Public Service employment was practically closed, his mind turned once again to the possibility of preparing town boys for land occupations and to his previous efforts in that direction.

In his report for the current year Mr. Story gives further consideration to the idea, and quotes from a previous review as follows:—

> Many metropolitan parents have sons whom they wish to settle on the land; lads who themselves wish to follow the occupations of the big outdoors. Even if these lads have finished the fifth class work by the age of thirteen, their parents very wisely think that they are too young to be taken from school and sent to farms to learn the work. The parents prefer that their boys should be kept for a while longer under parental control and receive some further schooling, but they desire that schooling to be preparatory in a measure to the country life. But if the boys go to secondary schools they receive much instruction which has not a direct bearing upon their prospective vocation; hence it is felt that a preparatory agricultural school is wanted to complete the scheme of educational organisation. The school must be within easy reach of Brisbane by rail, so that lads may be able to live at home and travel to and fro daily.

These remarks, Mr. Story points out, are as apposite in 1932 as when they were written. Progressive educational programmes are provided for the learned professions, commercial vocations, and industrial occupations, but similar facilities do not exist for the preparatory training of metropolitan lads for rural pursuits. Hence, the agricultural link is still missing. That link it is now proposed to forge, and it is not too much to hope that the establishment of a farm training centre at St. Lucia will not only be successful in bestowing definite benefit on town lads who look to country life as a career, but will have an important influence on agricultural development in Queensland.

Dairying in Queensland—A Great and Expanding Industry.

THE following points of general interest have been extracted from the annual report of the Under Secretary and Director of Marketing (Mr. E. Graham) to the Minister for Agriculture and Stock (Hon. Frank W. Bulcock):—

It is very gratifying to report another record year in dairy production. The output of the previous year was exceeded by 2,156,637 lb. The total output was 95,050,738 lb., as against 92,894,101 lb. for 1930-31.

Early seasonal conditions were favourable to high production, but this advantage was offset by the subsequent dry season, when the yield of milk diminished to a degree unknown in a normal summer. Otherwise, the increase in production would have been even greater. Seasonal conditions were not conducive to improvement in quality, but the maintenance of the previous high standard is evidence of sustained efficiency in face of conflicting circumstances. Dairy factory efficiency has also been maintained at a high level. Oversea realisation showed a sharp decline, while the home market was also affected by lower consumer incomes. The comparative stability of dairying has induced established farmers to increase their herds, and has attracted many others to the industry. The demand for dairy land has a tendency to increase values, and so create a risk of over-capitalisation, which would be detrimental to the industry. Dairying is rapidly becoming a major interest in the North, where large areas are suitable for its establishment and expansion. This development was mentioned in my last review, and still further progress has been made in the course of the year. Butter production on our tropical coast and northern tablelands is greatly on the increase. Its quality is unquestionable, as has been demonstrated by success in open competition, and it has a definite favourable influence on our export trade.

Cheese production, however, declined in volume as compared with the output of the previous year, and this is directly attributable to the subnormal seasonal conditions prevailing in districts which are our main sources of supply. The total out-turn was 11,006,663 lb. as against 13,642,237 lb. for 1930-31. The same circumstances affected quality, which did not reach the standard attained in the previous term.

Through modern breeding methods, carefully and intelligently practised, strains of dairy cattle, pure in inheritance for high production, can be developed, and under the guidance of the Department this is being done in Queensland. Success in dairying, of course, does not depend on breeding alone, but also on feeding and management, and departmental activities in this regard were constant throughout the year.

The system of herd-testing is gaining ground, farmers finding that this free service is of great advantage to them as a factor in economic dairying. They are realising its value in reducing costs of production, the necessity of which, in face

of lower price levels for their products, they cannot afford to disregard. They are finding out that rigorous culling of low-producing cows is a profitable practice, and is an essential point in successful dairy farm management.

The use of pure-bred sires of families of proved production is also becoming more general. Results are now observable in every dairying district. Many dairymen, too, are realising, though gradually, that poor cows, inferior sires, and inefficient methods of pasture and herd management are no longer tolerable economically.

Pasture improvement is another point in dairying practice that is receiving wider recognition. Our field grasses are the best and cheapest food for the milking cow, and in Queensland they constitute up to 80 per cent. of the food consumed by dairy cattle. The importance, therefore, of grassland management cannot be stressed too strongly.

The value of silage as supplementary stock food, especially in dry seasons on high-priced land, is also becoming more widely appreciated in practice, and results are evident in higher butter-fat returns.

Every endeavour has been made to place more prominently before dairy farmers the definite advantages accruing from the practice of systematical rotational grazing, fodder production and conservation, and improvement of pastures, both native and introduced. All three, obviously, increase the carrying capacity of the dairy farm, a factor which in these days of lowered prices, due to reduced consumer purchasing power and other causes, no practical man can afford to ignore. The number of stock per acre does not, of course, alone ensure dairying efficiency; it is the quality of the cows that counts. Therefore, methodical herd-testing is another dairying principle calling for more extensive application in practice and to which the Department directs attention continuously.

Dairying is one of our main exporting industries; its value in the economy of the Commonwealth is, consequently, very great, so efforts of the Dairy Branch are also concentrated continuously on raising the general standard of efficiency in the industry. Mechanical milking is another factor in the economics of dairy farming which is gaining steadily in favour. Rapid motor transport from districts remote from railways has contributed largely to the improved quality of dairy produce during recent years.

Juvenile project clubs in country schools are doing something to broaden the agricultural outlook, and the Department, in co-operation with the Department of Public Instruction, is assisting in fostering this movement. Prominent breeders of pure-bred stock have helped it materially, and the favourable attitude of parents of children engaged in club work is an acknowledgment of its value in rural life.

Fodder Conservation.

CLOSER attention is being given to the production of suitable fodders for dairy cattle. Many of these crops have, however, through stress of seasonal circumstances, been utilised by farmers in their early stages of growth.

The practice of systematic fodder conservation is extending. Silage, as an economic and convenient method of stock food storage, is becoming recognised more widely. Departmental effort is being directed consistently and (where farmers are willing and able to apply it in practice) satisfactorily towards the more general acceptance and application of this primary principle in agricultural economy. The common experience of seasonal adversity, throughout our dairying districts particularly, has had the effect of demonstrating the wisdom of making suitable and sufficient provision for the lean years that inevitably recur, and the value of which has been stressed repeatedly in previous reports.

Grass the Most Important Crop.

IN pasture improvement Mr. Graham reports good progress in the course of the year. Information on the subject is being sought to a much larger extent than hitherto. This increased interest he regards as evidence of a broader appreciation of the value of grass in our rural economy. Grass, after all, is the most important crop in the whole range of the State's production. In our grass lands we have a wonderful asset and a great inheritance. It is the best and cheapest of stock foods, and yet, through human perversity, it is the most abused. No country can make progress on worn-out pastures. The importance of grass in beef and butter making cannot be over-estimated, and the growing disposition to conserve and improve our pastures, both indigenous and introduced, is most commendable. Farmers are showing a general tendency, so far as our grazing resources are concerned, to look upon their ownership not as a license to impoverish the land, but rather as an obligation to preserve its full fruitfulness.

THE QUEENSLAND SUGAR INDUSTRY.

By H. T. EASTERBY, Director, Bureau of Sugar Experiment Stations.

PART XXXI.

Sugar Experiment Stations—concluded.

UP to 1924 the Bureau of Sugar Experiment Stations had not been able to give as much help to the industry in Soil Science, Pathology, Entomology, and Sugar Mill Technology, as it had hoped to do. This was largely due to the difficulty in securing trained men.

A start had been made with entomological problems as far back as 1911, as mentioned in the previous article—insect pests at that time and for some years thereafter being considered as causing the most serious damage the canegrower had to contend with. It had long been the chief aim of the present Director to acquire a trained scientific staff who would prove of value to the industry, and in 1922 he made certain suggestions to the Department of Agriculture for the appointment of a highly qualified Sugar Technologist to advise the sugar mills on manufacture, and also the appointment of a Sugar Cane Pathologist. Efforts were made in 1923 to obtain the services of a suitable man in Australia to take up the work of pathology in relation to sugar-cane, and when that failed the Department tried abroad, but there was a shortage of trained men available in the sugar countries of the world to supply the want. It was then recognised that the sugar industry would have to train its own men, and, fortunately, just about this time the late Chief Justice McCawley, who was a Senator of the Queensland University, made a suggestion to the Minister for Agriculture that out of the Cane Prices Fund three 3-year scholarships for selected University graduates should be awarded, with about £300 a year, the holders to undertake to work in the sugar industry of Queensland for at least three, perhaps five, years on completion of their course.

This letter was referred to the Director of the Bureau of Sugar Experiment Stations who quickly recognised the advantage that would accrue to the Bureau if he could secure these men when trained. He therefore recommended:—

> That the three students should not all take up the same lines of study while abroad, but that one student should be trained in Sugar Technology, one in soil and field problems, and one in plant pathology with special reference to cane diseases, the influence of climate and soils upon such diseases, and a study of bacteriology in connection with same. Such men would be of great value to the State and could at once be absorbed on the staff of the Bureau of Sugar Experiment Stations where difficulty was continually being experienced in obtaining trained scientific men. About the same time it was suggested by the Director that it would be wiser to allow the students to obtain twelve months' acquaintance with the sugar industry in Queensland, so that they would have some knowledge of local problems and some training in sugar matters before leaving Australia. These suggestions were approved by the Cabinet and various other interested bodies.

Conditions were drawn up, approved of by the Cabinet, and a Selection Board appointed consisting of the Public Service Commissioner, the Chairman of the Faculty of Science of the University, and the Director of Sugar Experiment Stations. An advertisement calling for applicants for these Travelling Research Scholarships was inserted in the papers, and fifteen applications were received. Each selector had a list of the applicants and their qualifications before him, and each selected the same three, namely—Messrs. H. W. Kerr for soils, A. F. Bell for Plant Pathology, and N. Bennett for Sugar Mill Technology.

After gaining some experience in Queensland in 1924, the students appointed left Australia and returned in 1928.

In the meantime, arrangements were made with the Queensland University to train cadets for entomological and pathological requirements, the Department of Agriculture paying these cadets an allowance on condition that they signed an agreement to remain in the service of the Bureau of Sugar Experiment Stations for a period of years after their training. In order that information might be obtained regarding the incidence of cane diseases, Mr. W. Cottrell Dormer (who is now assistant Pathologist) was appointed in 1924 to make a survey of the sugar-cane areas for disease. He subsequently attended the University and qualified for his degree with honours.

In 1928 the three Research Scholars returned with high credentials, and joined the staff of the Experiment Stations.

In 1929 the work of the Bureau was entirely reorganised and four divisions were instituted, with the officers mentioned in charge:—

Division of Soils and Agriculture—Dr. H. W. Kerr, Soils Chemist;

Division of Pathology—Mr. A. F. Bell, Sugar Pathologist;

Division of Entomology—Mr. E. Jarvis, Entomologist;

Division of Sugar Mill Technology—Mr. N. Bennett, Sugar Technologist.

Thus the specially trained officers were placed in charge of their respective divisions with the Director as administrative chief of the Bureau.

In 1912 the official staff of the Bureau consisted of only seven men. To-day it embraces twenty, as under:—

Director and administrative officers	3
Soils and Agricultural Division	10
Pathological Division	2
Entomological Division	4
Mill Technology Division	1

It is now proposed to give an outline of the work of each of these divisions.

Division of Soils and Agriculture.

In the reorganisation of this division at the outset, careful attention was given to provide adequate laboratory accommodation for the carrying out of the research work, and new chemical laboratories were

constructed in Brisbane. These were up to date in every respect, and the equipment permits of the study of practically any problem which it is found desirable to take in hand.

The Division of Soils and Agriculture has as its duties the full field experimental investigations of fertilizer requirements of the various soil types, the yielding capacity of new cane varieties, and the value of specific cultural treatments in increasing yields. The breeding of new varieties is an important phase of the work, which is receiving increasing attention.

Regarding the determination of fertilizer response on cane soils, it should be stated at the outset that the situation is a complex one. There is no other country where cane is cultivated successfully under such a wide range of climatic and soil conditions. The rainfall in the sugar belt ranges from excessively high to values where irrigation is essential for the growth of the crop; the temperature varies from tropical to sub-tropical, and the soil types are equally comparable in the magnitude of their variation. In considering fertilizer requirements, all of these factors enter. Consequently, it is necessary to set out fertility experiments on a large number of farms to determine the exact fertilizer required for each set of local conditions. The fact that sugar production in this country is carried on under the small-farm system further complicates the issue. In countries like Java and Hawaii, large proprietary companies operate both plantation and factory, and the work is supervised by a mere handful of agriculturists. In Queensland the number of suppliers is about 7,300, and the difficulties in dealing with each individually will be apparent.

However, it must be said that the results of this work justify the attention which has been paid to it. The experimental station results serve as a basis for the farm tests. These experimental blocks consist in general of twenty-five plots each one-twelfth to one-twenty-fifth of an acre in area, and five different fertilizer treatments are laid down. The system of experimentation is the latest approved method developed in recent years at Rothamsted, England. It can be claimed that the standard of accuracy of the results is superior to that of any other cane-growing country. Each of the plots must receive individual treatment and supervision; and, further, the whole plot must be carried through for at least three successive crops, in order to get a true measure of the fertilizer response.

At the present time about ninety farm experiments are under way in the various cane districts of Queensland. They are set out and supervised directly by the field officers of the Bureau.

Hand in hand with the field work goes the laboratory analyses of the soil types under examination, in order to determine the relationship between the field results and soil composition.

The question of securing the most suitable cane varieties for a particular set of conditions has been a very important one, and much attention is devoted to this aspect of the work. The large numbers of new canes imported from overseas have been subjected to yield trials against the old standard varieties, and those showing promise have been distributed amongst growers. The question of climatic and soil variation again enters into the issue; the leading varieties of

North Queensland being quite unsuited to Southern conditions, and vice versa. A very marked improvement in the quality and yielding power of the present-day varieties is observed. The legislation which governs the purchase of cane on its sugar content has been a great incentive towards the growing of sweeter cane, and it can be claimed that the sugar yield from a ton of cane in Queensland is now very much higher than that of any other cane-growing country. This point is well brought out in the following table:—

Year.	Acres Crushed.	Tons of Cane per acre.	Tons of Sugar per acre.	Total Tons of Cane Produced.	Total Tons of Raw Sugar Produced. 94 net titre.	Tons Cane Required to make 1 ton Sugar.
1900	72,651	11·68	1·20	848,328	86,631	10·09
1931	233,304	17·29	2·49	4,034,300	581,276	6·94

It is shown in the above table that, while the acres of cane crushed have slightly more than trebled, the production of sugar is now nearly seven times as great as in 1900.

During the past twelve years the breeding of new varieties suited to Queensland conditions has been pursued at the South Johnstone Experiment Station.

With a realisation of the value of disease-resistant varieties, the breeding programme has been revised during the past four years. Arrangements were made for the importation of a selection of the best breeding canes from Java, and these were used for the first time in cross pollination. It is hoped in this way to combine the disease-resistant qualities and vigorous-growing characteristics of the Java canes with the best qualities of Queensland standard varieties.

Cane seedling propagation has also been added to the activities of the Mackay and Bundaberg Stations, and it is trusted that canes especially adapted to the local conditions of these important centres will be produced.

All varieties of promise are subjected to rigid farm trial, after the manner in which we test fertilizers. When they have definitely proved themselves they are distributed for further planting.

An extension service has been built up, for the purpose of interpreting the scientific results into practical terms, for the assistance and guidance of growers. At present four field officers are employed in this service. Each is adequately equipped to travel throughout his territory, answering calls from farmers and giving desired information on sugar-cane agriculture in general. In addition, these officers advise on methods of disease and pest control, and are directly responsible for the laying out, supervision, and harvesting of all farm experimental plots.

Division of Pathology.

As previously mentioned the question of cane diseases was a serious one, and the considerable degree of ignorance in these matters made it imperative to secure the servics of a competent pathologist. Queensland was in the unenviable position of having present a greater number of the serious diseases of sugar-cane than any other cane-growing

country. Up till the close of the past century the knowledge of the cause and nature of sugar-cane diseases was very meagre, and consequently it was not possible for the authorities of the day to frame adequate regulations to prevent the introduction of diseases and pests. Unfortunately, by that time nearly all the serious diseases of cane were present in this country; on the other hand many countries (Cuba, for example) had escaped with at most one serious disease. The presence of so many diseases of cane in Australia is attributable to the fact that sugar-cane has been grown commercially from latitude 30 to latitude 16. In this belt there exists a wide range of climatic conditions which practically cover the entire range under which sugar-cane is grown throughout the world. The early planters imported varieties from nearly every sugar-cane country, with the inevitable result that practically every serious disease was imported also. The presence of these diseases has been a very important factor in retarding the progres of the industry.

Records show that various individuals and commissions investigated the question of sugar-cane diseases from the very early days of cane culture, but the first sustained investigations in Australia were made in the nineties by Cobb (N.S.W.) and Tryon (Q'land), and later by Mr. D. S. North of the Colonial Sugar Refining Company. The present Director recognised the need for the services of a Pathologist specialising in sugar-cane diseases, and efforts were made to secure a suitable man for the position, but without success. It was therefore decided, in 1923, as previously mentioned, to send a Queensland graduate abroad for the necessary training to enable him to fill the position of Pathologist. In the meantime students were recruited from the Queensland University, and these were engaged upon a disease survey of the sugar belt. Upon the return of the Pathologist from abroad the Division of Pathology was created, and the following year laboratories were erected in Brisbane.

The following are the most important cane diseases found in Queensland:—gumming, leaf-scald, Fiji, mosaic, downy mildew, red rot, and red stripe. Of these the most serious is gumming; but, fortunately, it is confined almost entirely to the South, as is Fiji disease. Leaf-scald and red stripe are of importance in the North, while mosaic and downy mildew are found throughout the State, but are serious only in scattered localities.

There have been two serious epidemics of sugar-cane diseases in the history of the Queensland industry, viz.:—the so-called "rust" in the seventies, and gumming disease in the nineties. The disease known as rust was very imperfectly described by the early investigators, and it is impossible to say whether this disease was the true rust or not. Certainly the descriptions as given do not in the least resemble any of the present major diseases. Both this disease and the gumming disease of the nineties were slowly brought under control by the gradual substitution of other varieties. At the present day, gumming disease is again epidemic in the Southern district, while leaf-scald is wide-spread in the Northern district.

Under the small-farm system obtaining in Queensland, where the farmer has naturally not the time to specialise, the control of diseases presents a problem which is incomparably more difficult than it would be under the plantation system of cane culture, and almost the sole line of attack lies in the production of resistant varieties. Consequently the most important work of the Division of Pathology lies in

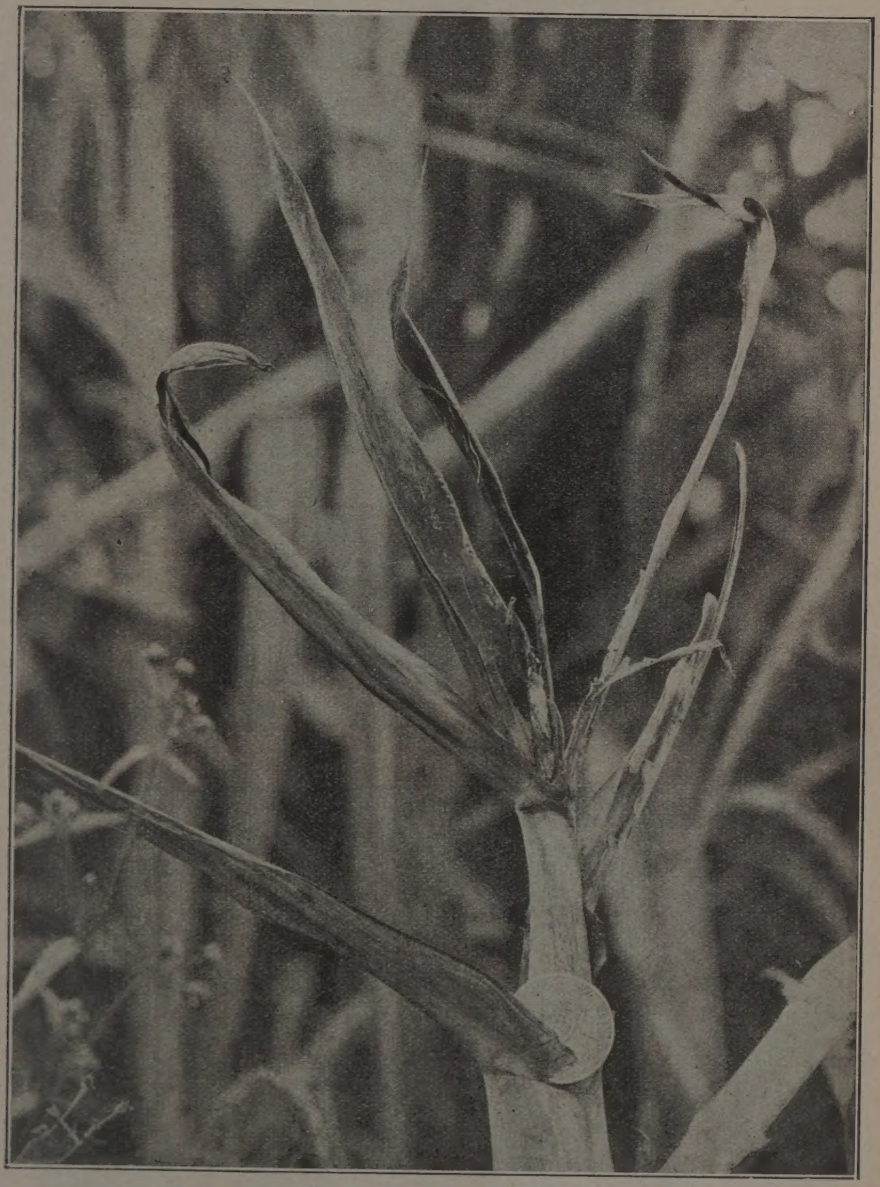

PLATE 151.—Typical Symptoms—Fiji Disease.

PLATE 152.—*Leaf Scald.* One-year-old diseased Mahona showing the typical etiolated, withered, and curled-in leaves of cane top, as well as the production of side shoots.

PLATE 153.—*Leaf Scald.* On right, feeble chlorotic shoots commonly arising when infected sets are planted. The fourth leaf of the plant second from the left bears a characteristic fine white pencil streak.

the conducting of field resistance trials. Seedlings are now being raised in each of the three main districts and will be tested for their reaction to any important diseases to which they are likely to be exposed, and only those varieties which exhibit a satisfactory degree of resistance will be propagated and distributed. By this means it is expected that the major diseases will eventually be controlled automatically. At present resistance trials are being conducted in connection with gumming, leaf-scald, red stripe, mosaic, and Fiji diseases. To date the main attention has been focussed on gumming disease, and during the past three years trials aggregating about 250 varieties have been conducted. As a result of these trials a number of highly resistant varieties have been developed, and the prospects for the complete control of this disease in the near future are very bright. Leaf-scald will now receive the chief attention, and at present approximately 1,000 varieties are being tested for scald resistance to determine their suitability for commercial propagation or as breeding canes.

As a result of the low economic value of the individual sugar-cane plant, and the extent of present knowledge, the question of a "cure" for cane diseases cannot be entertained, and control must lie wholly in prevention. The methods of prevention available are:—

(1) Quarantine;

(2) The growing of resistant varieties;

(3) The use of disease-free plants;

(4) Field sanitation.

These methods are briefly summarised hereunder:—

(1) Quarantine is of two types, foreign and local. Foreign quarantine deals with varieties introduced from abroad. These are now grown in isolation for a year, under the supervision of the Bureau, before being utilised.

Fortunately, the distribution of diseases is not general, and to minimise the likelihood of further spread into new areas, seven local quarantine districts have been created. The interchange of cane between these districts is prohibited, except by permission of the Bureau.

(2) The growing of resistant varieties has already been referred to.

(3) The use of disease-free plants.—The services of the Bureau's officers are at the disposal of farmers in their selection of cane for planting. In addition, in the areas where the disease situation is worst, the farmers' organisations have sought the aid of the Bureau in establishing isolated nursery plots for the supply of disease-free plants. This sound scheme, which has the full approval of the Bureau, has now been undertaken in three districts.

(4) Field sanitation.—This includes all farm practices, such as uprooting and destruction of diseased plants where necessary, burning of trash and rubbish liable to harbour disease, eradication of weeds, adequate drainage, &c.

Full details concerning the diagnosis and control of some forty cane diseases are set out in the handbook, "A Key for the Field Identification of Sugar-cane Diseases." It should be mentioned that this

publication, which was prepared by the Pathologist to the Queensland Bureau of Sugar Experiment Stations, is accepted throughout the world as the standard work on sugar-cane diseases.

Division of Entomology.

Of particular importance are the insect pests of cane, and these are the subject of the special attention of the Division of Entomology. Entomological laboratories have been established in the three main divisions of the sugar belt, and here a continuous search is made for cheaper and more efficient methods of control of pests. The division is greatly aided in its extension activities by the Cane Pests Boards, a number of which have a field representative appointed for the purpose of instructing farmers in methods of control.

The outstanding insect pests are the grubs of the greyback beetle, a beetle known as Frenchi, and the Childers cane beetle. There are certain features of these pests which require emphasis. They are indigenous to Australia, and consequently the possibilities of control by introducing a parasite from abroad are not promising. Having been established in Australia before the introduction of cane, they have other host plants, and thus their extermination is impossible. There is no way in which a farmer can escape the visitations of the beetles which fly into the fields and deposit their eggs at the base of the cane stool. The greyback beetle is possibly the worst pest of sugar-cane in the world, and annually causes losses in North Queensland of upwards of £100,000.

The grubs voraciously attack the roots, ultimately causing the cane stool to lose its hold in the ground and fall over. As the greater part of this damage is done before the mills commence crushing, the cane dies and becomes a total loss. As a result of research on the part of the Bureau, several methods of attack have been developed, the most successful being the use of the chemical fumigants, carbon-bisulphide and paradichlorobenzene. A census is taken of the number of grubs per stool of cane in order to determine whether the damage is likely to be such as to warrant the expense of fumigation. Should this be the case, the fumigant is then injected at the base of the cane stool. Unfortunately, this method of control is costly, and hence cannot be used unless the degree of infestation is high.

An important phase of the activities of the Division of Entomology is the search for natural enemies of cane pests. This method of control is particularly desirable on account of the small cost involved. A notable success in this direction has been attained in the control of the weevil borer, by the introduction from New Guinea of the parasitic Tachinid fly. These flies are bred in large numbers in special cages by the Bureau at Meringa, and are liberated in infected fields, upon the application of growers.

Other important insect pests which have been the subject of investigation by the Division of Entomology are wire worms, army worms, moth borers, grasshoppers, and white ants. The habits and life histories of these insects have been determined, and methods of control evolved in each case. All relevant information concerning these and other insect pests is made available to farmers in the form of bulletins, pamphlets,

and newspaper reports. These are all summarised in Bulletin No. 3, "Notes on Insects Damaging Sugar-cane in Queensland," written by the Entomologist to the Bureau of Sugar Experiment Stations.

It is estimated in addition to the work of the Bureau of Sugar Experiment Stations in combating cane pests that a sum of more than £50,000 has been expended by the Cane Pests Boards and Committees during the last seven years in the destruction of pests attacking sugar-cane. The greater part of this money is directly contributed by the sugar industry itself.

The first entomological laboratory, which was situated at Gordonvale, consisted of a large six-roomed building rented by the Department of Agriculture for this purpose, lying within a stone's throw of the Mulgrave Central Sugar Mill.

Being practically surrounded closely by canefields, the site offered an ideal spot from which to carry out entomological research work. By the end of six years, however, increased activities in connection with the control of cane insects, together with the necessity for providing accommodation for a resident entomologist and assistants, and a better equipped laboratory, led to the establishment by the Bureau of an Experiment Station at Meringa.

The spot selected for such purpose was a portion of the Recreation Reserve, about 13 miles from the city of Cairns, a tropical part of the State, situated within 18 deg. south of the equator, and having an average rainfall of about 92 in.; while the minimum and maximum temperatures range respectively from 68·4 to 83·7 deg. Fahr.

Entomological Laboratory at Bundaberg.

Up to 1926 little had been done in establishing the identity or means of control of any of the more important insect pests in the canefields of Southern Queensland.

It was known that "white grubs" were a serious problem in some districts, and short visits had been paid to parts of the affected areas by different entomologists in order to collect material, and compare infestation and habits of these pests with the "greyback" cockchafer in North Queensland. These visits and investigations were, however, spasmodic, and owing to the greyback problem being a more important and urgent one, work was concentrated on this pest to the almost total neglect of the Southern pests.

The Southern sugar districts consist of Bundaberg, Gin Gin, Isis, Maryborough, Pialba, Bauple, Nambour, and Beenleigh, and these were included in the territory wherein it was proposed to proceed with these investigations. A survey of the districts was first undertaken, and it was soon evident that "white grubs" were the most serious insect problem in the South, and, furthermore, that there were several species involved. The districts most adversely affected by these pests were Isis, Gin Gin, and Bundaberg. Pests of minor importance were for the most part found in the other districts, and owing to the prevalence of certain serious sugar-cane diseases there, their possible importance in the role of vectors of these diseases could not be overlooked.

PLATE 154.—Entomological Laboratory at Meringa.

PLATE 155.—Entomological Museum at Meringa.

Soon after this survey work was completed, a laboratory was established at Bundaberg and fitted out with the necessary equipment for carrying out entomological investigations. In addition a reference collection has gradually been built up, and preserved specimens of most cane pests and parasites are on view, for the information of growers and others interested in this particular branch of the Bureau's activity, and they may obtain advice on all pests connected with the growing of sugar-cane.

Work was first commenced on establishing the identity and working out details in connection with the life histories of these "white grubs" previously referred to. It was found that two years were required for their complete development and they included the following species:—*Pseudoholophylla furfuracea* Burm., *Lepidiota trichosterna* Lea, and *Lepidiota frenchi* Blkb.

P. furfuracea was found to be the most important pest, and infestation was worst on the red volcanic soils, the areas which originally supported dense scrub vegetation. Next in importance came *Lepidiota frenchi* and *L. trichosterna*, the "frenchi" grub being a pest chiefly on forest lands.

Control measures have been worked out, and these aim in so regulating planting and giving attention to correct cultural operations that conditions are made unfavourable for the wholesale development of the pests. Where pests are established in growing crops, soil fumigation is necessary, and a soil fumigant has been evolved which gives a high percentage of mortality. By co-operating with the local Farmers' Associations it has become possible to supply to growers troubled with these pests fumigants at cost price, and injectors are also loaned out at a nominal rental. At the same time they are instructed in the method of applying this fumigant, and every encouragement is given them to clean up their damaged areas and thereby prevent further trouble being stored up for them in the future.

In former years, it was thought by growers generally that a high degree of control was gained by the collection and destruction of beetles of the species of *P. furfuracea*, which had been attracted to light traps and collected therefrom. These beetles were paid for by a Pest Destruction Fund at the rate of 1s. 6d. per quart, and the money expended yearly in this connection was considerable. Investigations by the Bureau showed that approximately only 1 per cent. of those caught at light traps were females and the control gained thereby was negligible, and on the recommendations of the Bureau payment for this species of beetle was abandoned.

In the early stages of investigations, it was realised that the weevil borer *Rhabdocnemis obscurus* had not become established in the South, and no real danger from this pest existed, so long as no importations of cane plants were made from North Queensland. Accordingly, inter-district quarantines were established by the Pathologist, and proclamations were made prohibiting the introduction of canes beyond certain boundaries without a certificate giving them a clean bill of health. In this way it is hoped to effectively keep this pest out of Southern districts.

Entomological Laboratory at Mackay.

In January, 1928, an Assistant Entomologist was sent to Mackay and a laboratory provided for his work, which, so far, has been chiefly in connection with the wireworm damage to cane.

Cane Pests Boards.

Sugar-cane is a sweet succulent plant and is naturally the prey of many insect and animal pests. During the past thirty years pest committees were instituted to deal with pests such as grubs, rats, &c., which committees were usually provided for by funds voluntarily subscribed by the local canegrowers and subsidised by the mills in the district, and to some extent by the Government. It was, however, felt that all farmers should be made to subscribe to these funds, and an attempt was made in 1916 to introduce legislation to that effect, but the amendments in the Bill made by the Legislative Council were not acceptable to the Assembly. At a later date—viz., in 1923—at the desire of representatives of the canegrowers, the Government of the day amended the Sugar Experiment Stations Act so as to provide for the constitution of Cane Pests Boards when a request for same was made by a majority of canegrowers in a district, and the making of a levy of not more than three pence on every ton of sugar-cane received at any sugar works within a cane-pest infested area, to be paid by the growers and millers in equal proportions. From this fund, which was to be administered by the various Cane Pests Boards, payment was to be made for the prevention and suppression of such animals, birds, and insects as were set forth in the regulations. These comprised:—

Animals—Rats, wallabies, mice, kangaroo rats, foxes, wild pigs.

Birds—Red bills or coots.

Insects—Cane beetles, cane grubs, moth borers, weevil borers, beetle borers, bud moths, plant bugs, wireworms, grasshoppers, locusts, army worms, set eaters, white ants, caterpillars, plant-eating beetles, leaf hoppers, plant lice, mealy bugs.

Up to date seven Cane Pests Boards have been constituted under "*The Sugar Experiment Stations Act Amendment Act of* 1923"—viz., Plane Creek, Mackay, Lower Burdekin, Ingham Line, Tully, South Johnstone, and Mossman.

Division of Sugar Mill Technology.

Early in the history of the Sugar Experiment Stations attempts were made to provide the Queensland sugar-mills with technical assistance, and Mr. J. C. Penny, who had been with the Sugar Experiment Station at Hawaii, carried out for a short time the duties of chemical Inspector of Sugar Mills, afterwards resigning on being appointed to the position of manager of Farleigh Mill. Subsequently Mr. J. C. Brünnich performed some work in this connection for the Bureau, but his services could not long be spared by the Agricultural Department.

The present Director, however, was anxious that the mills should have assistance and advice, and, as already pointed out, it was arranged that one of the travelling students should take up the study of sugar-mill technology, and as the graduate selected (Mr. Norman Bennett) had already had experience in Queensland sugar-mills, he left Queensland in 1924 and did not return till 1928. During that time he visited Java, Scotland, Louisiana, Cuba, Hawaii, and the Philippine Islands. Upon his return, the Division of Sugar Mill Technology was formally constituted within the Bureau of Sugar Experiment Stations.

Pending closer examination of the requirements of the Queensland mills, no further appointments were made at this early stage of the establishment of the Division, and Mr. Bennett's duties were defined in such a way as to advise and assist mill managers, mill engineers, and mill chemists in all stages of the manufacture and technology of sugar.

For the first season, 1928, the officer appointed visited all Queensland mills, with the exception of those of the Colonial Sugar Refining Company. As the result of this survey of the mills, the establishment of the Division was undertaken along the following lines:—

1. The establishment of a society independent of the Division which would arrange for periodical gatherings of Queensland Sugar Technologists for the purpose of discussing their problems.

2. The establishment within the Bureau of a system of standardisation for laboratory apparatus and technique.

3. The establishment within the Bureau of a system of mutual control for those Queensland mills who were willing to forward the results of mill-working periodically to the Division. The system to be adopted for this mutual control was elaborated by the technologists and submitted to a special committee of chemists appointed by the Queensland Society of Sugar Cane Technologists for ratification.

4. The establishment of a technical and research laboratory.

5. The appointment of a technical engineer and a technical chemist to assist the mills in the elucidation of their problems.

During the period which has elapsed since the inception of this work, the organisation of the Division has proceeded slowly but surely along the lines set out above. However, owing to financial difficulties, the appointment of a technical engineer and a research chemist has been delayed, and on the expiration of his agreement with the Government Mr. Norman Bennett resigned and took up the position of manager of Racecourse Sugar Mill. At the present time the staff of the Division consists of an assistant sugar-mill technologist and a librarian and clerk who is in charge of the mutual control scheme.

One of the chief difficulties with which this Division of the Bureau has to contend, and which will become more pronounced in future years, is the fact that the officers of this Division, after some years' experience, will be qualified to assume responsible positions in the industry outside the Bureau of Sugar Experiment Stations, and the Division must be prepared to lose specially-trained men to individual sections of the industry. The position is unfortunate, but it must be borne in mind that one object of this Division of the Bureau of Sugar Experiment Stations should be to train juniors and students for the outside work required by the industry.

The question of the utilisation of by-products is one that immediately concerns the Technology Division of the Bureau. At present, molasses is being used for the manufacture of power alcohol, which is being mixed with Shell benzene and having considerable success as an internal combustion fuel under the name of "Shellkol," and further factories for its manufacture will in all probability be erected. Other by-products such as building board and artificial silk manufacture have been under consideration. With regard to the former,

the establishment of a factory has been before the industry for about six years, but the price offered for bagasse is not commensurate with the value of the raw product to the mills as fuel. The sugar technologist pointed out that "the requirements of the Australian market for such materials as building board, artificial silk, industrial alcohol, and methylated spirits are limited. Actually, the problems of the utilisation of the by-products of the sugar industry are not technical, but are fundamentally economic. Before any extension of these secondary industries can take place a sure market must be developed for the finished articles."

General.

During the past twenty years thirty-two Bulletins on Agriculture, Pathology, and Entomology have been issued by the Bureau in addition to numerous circulars and leaflets.

The sum of £325,855 has been expended on experimental work since the inception of the Bureau of Sugar Experiment Stations in 1900. Its work in connection with the sugar industry cannot be overestimated.

The Queensland Society of Sugar Cane Technologists.

In March, 1929, a conference of mill managers, mill engineers, and mill chemists was called in Mackay to discuss the problems dealing with the milling section only, and to consider the formation of a society of sugar technologists. At this conference, representatives of sixteen sugar-mills, six engineering firms, the Cane Prices Board, and the Bureau of Sugar Experiment Stations were present. After four days of particularly interesting discussion, the conference formally decided to establish a permanent body, to be known as the Queensland Society of Sugar Cane Technologists, and with the following objects:—

1. The promotion of discussion of technical problems of the Queensland sugar industry by annual conferences held in the sugar centres of Queensland.

2. The arrangement for the publication and distribution of technical literature on all matters dealing with cane sugar.

3. The affiliation and co-operation with the International Society of Sugar Cane Technologists.

The proceedings of this first conference of Sugar Mill Technologists was printed by the Bureau of Sugar Experiment Stations at the request of the newly-formed Society and distributed to all mill managers, mill engineers, and mill chemists. The first officers of the Society were—

President—Mr. W. F. Seymour Howe, General Manager of the Mulgrave Central Mill.

Honorary Secretary—Mr. Norman Bennett, Sugar Technologist to the Bureau of Sugar Experiment Stations.

Executive—Mr. H. S. Goldsmith, General Manager of Walkers Limited; Mr. W. Pollock, Chief Engineer of the Tully Central Mill, representing sugar-mill engineers; Mr. C. H. O'Brien, Chief Chemist, Mossman Central Mill; and Mr. M. A. Doolan, Chief Chemist of the Mulgrave Central Mill.

Commencing with a membership of forty, comprised chiefly of mill managers, engineers, and chemists, the scope of the Society's activities was widened to include all agricultural sections at the First Annual Conference held in Cairns in 1930. In 1931, the Second Annual Conference of the Society was held in Bundaberg and was attended by some 100 delegates from all sugar centres in Queensland, while in 1932 the Third Annual Conference was held in Mackay with an attendance of 108 delegates.

There are at the present time 257 members on the roll, comprising 155 full members and 102 associate members. The need for such a Society has now been generally recognised by the leaders of the sugar industry, and its work has received recognition outside Australia, prominence being given to extracts from papers in such leading sugar journals as "The International Sugar Journal" and "Facts about Sugar."

The President of the Society is now Mr. J. W. Inverarity, and Mr. J. M. MacGibbon is the Honorary General Secretary.

The Society is materially assisted in carrying out the objects for which it was formed, by the Queensland Cane Growers' Council and the Australian Sugar Producers' Association.

[THE END.]

TO NEW SUBSCRIBERS.

New subscribers to the Journal are asked to write their names legibly on their order forms. The best way is to print your surname and full christian names in block letters, so that there shall be no possibility of mistake.

When names are not written plainly it involves much tedious labour and loss of valuable time in checking electoral rolls, directories, and other references. This should be quite unnecessary.

Some new subscribers write their surname only, and this lack of thought leads often to confusion, especially when there are other subscribers of the same surname in the same district.

Everything possible is done to ensure delivery of the Journal, and new subscribers would help us greatly by observing the simple rule suggested, and thus reduce the risk of error in names and postal addresses to a minimum.

Bureau of Sugar Experiment Stations.

ENTOMOLOGICAL HINTS TO CANEGROWERS.

The Northern Entomologist (Mr. E. Jarvis) has submitted the following hints for November to the Bureau of Sugar Experiment Stations:—

Grey-back cockchafers should make their appearance about the middle or end of this month, the date of such emergence corresponding with that of the first decided fall of rain. Unless the present dry conditions chance to continue throughout November and well into December we may expect a liberal occurrence of cane beetles. It is interesting to note, however, that the critical five months occupied by the pupal condition of our grey-back beetle have not proved too favourable to the normal development of this life-cycle stage, the rainfall registered at Meringa during the period in question having been less than 4 inches, whereas the average precipitation during these five months in the Cairns district (over the last forty years) is 9.87 inches.

During the present month (November) farmers should make a point of reading the notes on grub fumigation, which were published last July in the "Queensland Agricultural Journal" (Vol. xxxviii., pages 6 and 7); or in the "Australian Sugar Journal" (Vol. xxiv., page 175, July, 1932), as these notes will be found helpful to growers intending to fumigate their cane against grubs of the grey-back cockchafer.

Collecting Beetles from Feeding Trees.

Preparations should now be made for collecting cane beetles on plantations where feeding-trees of this insect happen to be conveniently situated, and can be used as trap trees. The "Weeping Fig," "Moreton Bay Ash," &c., are favourite food-plants, and generally attract most of the beetles in the vicinity of a canefield. When found growing close to headlands, it will be found a good plan to clear away the vegetation from under such trees to within a radius of a chain or two, in order to induce beetles to concentrate upon them, and to facilitate collecting from same.

Caterpillars of Moth-Borers of Cane.

Evidence of the presence of the "Large Moth-borer," together with indications of damage resulting from the attacks of larvæ of our smaller species of moth-borers will be noticed this month amongst young shoots of ratoon and plant cane. The so-called "dead hearts" caused by such mining caterpillars are due to destruction of the central heart-leaves, and during certain seasons are very conspicuous amongst young cane on low-lying river flats. The shoots of third ratoon crops are often injured by caterpillars of the "Tineid Moth-borer," the highest number of young shoots destroyed per stool being from ten to twenty. Control measures consist in cutting out the dead-hearts to a depth of about 2 inches below ground level, particularly those which are wilted but still slightly green or yellowish-green, as these shoots generally contain the caterpillar responsible for the damage, or its pupa. Needless to say, these should be crushed or otherwise destroyed.

Grasshoppers and Army Worms.

Canegrowers are asked to report to the Entomologist at Meringa any occurrences of the small hopper stage of such locusts as the Yellow-winged grasshopper, &c., which may chance to appear on their plantations, in order that this pest may be combated without delay while in its early wingless condition. Similarly, any serious infestation of cane by caterpillars of the "Army worm" should be promptly made known. Now is the time for overhauling spray pumps, and after cleaning same replacing defective washers, &c., by new ones. A supply of lead arsenate should be on hand; same is procurable at 1s. 6d. per lb. in 7-lb. tins, and 1s. 1½d. per lb. in a case of 112 lb. When spraying against leaf-eating caterpillars or beetles, use 1½ to 2 lb. arsenate in about 50 gallons of water.

In Memoriam.

HARRY TINNISWOOD EASTERBY.

BY the death of Mr. Harry T. Easterby, Director of the Bureau of Sugar Experiment Stations, the sugar industry has lost one of its most notable personalities and Queensland a fine citizen. Making a tour of the cane-growing districts, he was in the office of the Cairns Canegrowers' Association when he suffered a sudden seizure which terminated fatally on Wednesday, 28th September, so he practically died in harness.

An excellent administrator and a master of method, Mr. Easterby characteristically left everything in perfect order. For some time past he had been engaged in writing a history of the sugar industry, a work comprehensive in its scope, which on its publication in book form will be accepted as an authoritative survey and as a valuable record of the establishment and development of one of Australia's greatest agricultural enterprises. To him it was a labour of love and the last chapter was ready for the printer just before he left Brisbane on what was to be his final visit to the North.

Mr. Easterby's death is a distinct loss to the State which he loved and served so well; and also to the industry in which was bound up his life's work, and which he helped on its technical, scientific, and administrative sides to develop to the stage it has reached to-day. In fact, for many years he ploughed a lonely furrow, and on his shoulders rested the entire investigational work of the Bureau until in time it became possible to appoint an adequate staff. It is believed that the heavy work entailed in the organisation of the services of the Bureau, entailing as it often did actual hardships in the years when transport and other facilities were anything but modern, undermined a powerful physique to an extent that was largely the cause of his ultimate breakdown.

Great in heart and ability, big in achievement, firm and courageous in his convictions and rigid in honesty of purpose, he was regarded as a man among men. His thoughtful consideration of others, geniality of manner in all personal contacts, his capacity for inspiring the affection of his associates made of him an exemplar of what is best in humanity.

Harry T. Easterby was born at Echuca, Victoria, in 1867. He studied at the Horsham (Victoria) Public School, and applied himself to chemistry and microscopical science, including sugar chemistry, and subsequently entered the sugar factory at Maffra in 1897, where he studied the technology of sugar under Dr. Riesen. He was afterwards appointed to the position of chemist with Messrs. Gibson and Howes, owners of the Bingera Sugar Plantation at Bundaberg. Mr. Easterby was engaged later by the Victorian Government to make investigations into the beet sugar industry in 1900 and part of 1901, after which he was appointed Assistant Director of Sugar Experiment Stations in Queensland to Dr. Walter Maxwell. He subsequently became Director, which position he held up to the day of his death.

The Sugar Experiment Stations during Mr. Easterby's long term of office developed remarkably. At the time he joined the service there was only one station in Queensland. Now there are three; also three entomological laboratories, a sugar-cane pathological laboratory, a sugar soils laboratory, and a sugar mill technologists' laboratory; while the staff has increased from six to twenty-two, including chemists, pathologists, entomologists, and agriculturists; while the yield of sugar has increased from 120,858 tons in 1901 to 581,276 tons in 1931, and the tons of cane required to make 1 ton of 94 net titre sugar have been reduced from nearly 10 in 1901 to well under 7 during the past two seasons.

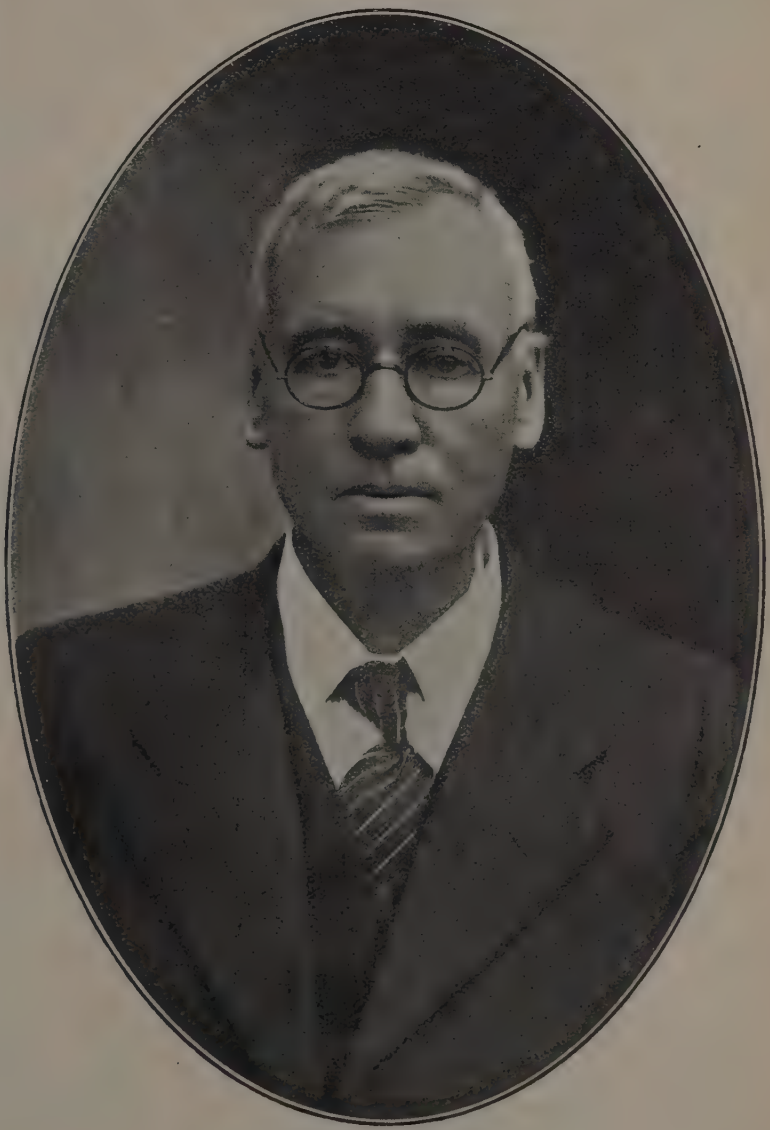

PLATE 156.
The Late HARRY T. EASTERBY.

In addition to his services as Director of the Bureau, Mr. Easterby's comprehensive knowledge had been availed of on different occasions in other directions. He was called on by the Victorian Government in 1915 to advise as to the future of the sugar beet industry in Victoria; had sat on three Royal Commissions connected with sugar, and in 1929 was one of the Queensland delegates at the Triennial Conference of the International Society of Sugar Cane Technologists, held in Java, and was vice-chairman of the Queensland section of that Society.

Few sugar men have had opportunities to apply themselves to a close and diligent study of both the cane and beet spheres of that industry, but Mr. Easterby was included in the select minority.

His keenness for his work, his unusual organising capacity, and his ability to win the confidence, co-operation, and sympathy of the growers and millers throughout the State, contributed in no small way to the success which attended his labours. A genuine desire to give of his very best permeated the man. His close application to the various problems with which he had to grapple, his perseverance and his immunity from discouragement through temporary checks, and the simple sincerity of the Director, soon won for him a place of esteem in the eyes of all growers and millers.

Mr. Easterby knew his cane growers, and the cane growers knew him. They understood one another, and a peculiar bond of appreciative sympathy existed between them.

As a regular contributor to these pages Mr. Easterby was well known to our readers. His record of the industry, the concluding chapter of which is published in this issue, will be accepted as an authoritative document, dealing as it does with the development of the industry in this State from every angle. There was, perhaps, no one more qualified that Mr. Easterby—by both long experience and active participation in every phase of the industry in field and factory—to undertake the task of compiling an authentic record of development and events that make up the story of one of Australia's greatest rural industries. It was a pathetic circumstance that with the end of his history of the Queensland sugar industry came the end of a life devoted almost exclusively to its interests and progress. By his share in the moulding of sugar policy he performed great service to Queensland. His personal influence on the sugar industry was pronounced and remains indelible.

Apart from his intense interest in agriculture and its problems, Mr. Easterby was a student of classical and modern literature, Shakespeare being his favourite among the moderns. Microscopy was another of his leisure-hour hobbies.

In the passing of Harry Easterby there has gone from among us a man who was not only a notable figure in the agricultural life of Queensland, but who, as a good Australian, had all those fine qualities of mind and character that win and hold the affections and deep respect of his fellow men. It can be truly said of him that he served well his day and generation, and his work for the sugar industry of Queensland will remain a lasting monument to a life spent largely in its service.

The late Mr. Easterby was laid to rest on 29th September in the Cairns Cemetery, after a short service at St. John's Anglican Church. Gathered around the graveside were his son, Mr. R. T. Easterby, and numerous representatives of the sugar industry, the Department of Agriculture and Stock, and every other section of the community. Many fine tributes to his worth and work were paid by the metropolitan and country Press and leading citizens, including the Premier, Hon. W. Forgan Smith, and the Minister for Agriculture and Stock, Hon. Frank W. Bulcock.

To the bereaved relatives deepest sympathy is extended.

THE FIJI DISEASE MENACE IN SOUTHERN QUEENSLAND.

By ARTHUR F. BELL, Pathologist.

OWING to the danger of Fiji disease becoming a serious menace to newly introduced varieties of sugar-cane in Southern Queensland, the following notes have been compiled in order to describe the symptoms by which the disease may be recognised; and to set out the methods by which it may be controlled.

Under suitable conditions Fiji disease can be one of the most destructive of all sugar-cane diseases. This disease takes its name from the country where it was first observed some twenty-five years ago, and most canegrowers will recall that for some years the sugar industry of Fiji was very seriously affected by the ravages of the disease. Fiji disease has been known in Southern Queensland for a number of years, and is widely distributed in the Maryborough and Beenleigh districts. By the exercise of the recommended control measures a great improvement has been brought about by the Beenleigh growers, but the situation in the Maryborough district is still very unsatisfactory. In the last few years the disease has been found in a number of scattered farms in the Moreton and Bundaberg-Isis districts. The varieties mainly affected at present are D. 1135 and 1900 Seedling, which are also susceptible to gumming disease and are gradually being discarded.

Unfortunately, some of the promising new varieties, including P.O.J. 2878 and other P.O.J. canes, have been found to be quite susceptible and the presence of Fiji disease constitutes a grave danger to the successful cultivation of these canes. In order to bring under control the very serious gumming disease, only varieties which have been proved resistant to gumming disease are now released for testing in the field. It is very important, that such work should not be hindered by infection with Fiji disease, particularly in the Bundaberg-Isis and Moreton districts, where gumming disease is worst and where Fiji disease could be practically eradicated with little trouble.

The presence of scattered stools with Fiji disease, however few, must be viewed seriously, and it would be well to take warning from recent developments in certain parts of Fiji. For many years the rate of spread of the disease had been quite slow, but, following the floods of some three years ago the rate of spread suddenly increased enormously, and in many fields the number of infected stools has increased ten-fold.

Symptoms.—Diseased setts will always give rise to diseased plants, and in most cases such plants will form no cane, but the stool will consist of a cluster of stunted shoots such as is illustrated in the foreground of Plate 157. The leaves of these stunted plants are short and erect, and generally of a darker green colour than the leaves of healthy plants. On examination of the under surface of these leaves there will

PLATE 157.

The stunted stools in the foreground resulted from the planting of diseased cuttings.

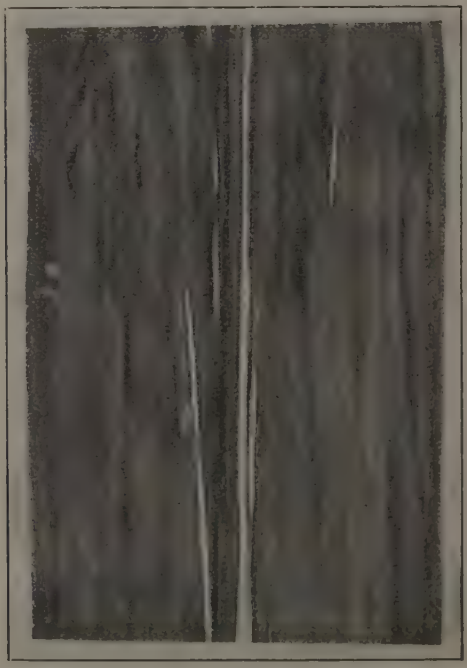

PLATE 158.

Small galls characteristic of Fiji disease on under surface of leaf, with one greatly elongated gall on the midrib.

be found the small galls which are characteristic of the disease. These are well illustrated in Plate 158; they are yellowish in colour, about 1-32 to 1-16 of an inch in diameter, and may be up to several inches in length, although the majority are only about half-an-inch long. They follow the direction of the veins of the leaf and are, in fact, enlarged veins. Such stunted diseased stools are readily found as soon as the surrounding healthy stools have commenced to make cane.

Diseases of this type are usually spread from plant to plant by insects, and if the stunted diseased stools described above are not uprooted and destroyed, the surrounding healthy stools will gradually become infected. This is known as secondary infection, and the diseased stalks present a very striking appearance. The leaves become stunted and stand out stiffly from the crown, while the younger leaves curl inwards and frequently have brownish scalded margins. The general appearance is as though some animal had bitten off the tops of the leaves, and is well illustrated in Plate 159. In cases of secondary infection often only one or two stalks may appear diseased, while the remaining stalks of the stool appear healthy. No further growth of the stalk follows after the production of these stunted leaves; the young leaves now produced gradually become smaller and smaller, and eventually the stalk dies.

Fiji disease is generally worse in ratoons than in plant cane. Ratoons from diseased stools produce only a cluster of small grass-like leaves on which, however, the characteristic leaf galls may be found.

Control.—The following methods of control are advised:—

1. Fiji disease is spread from farm to farm by means of diseased cuttings, and, therefore, careless exchanging of varieties cannot be too severely condemned where this disease exists.

2. Make a row-by-row examination of any cane intended for planting purposes and absolutely reject any field in which Fiji disease is found. Cane for planting purposes should be grown from specially selected stock in small "Farm Nursery" fields which can be inspected frequently.

3. Old susceptible varieties such as D. 1135 and 1900 Seedling should be discarded as soon as possible; this particularly applies to D. 1135 in the Moreton district. The varieties Q. 813 and H.Q. 285 are fairly resistant and their planting is encouraged.

4. Make careful inspections of the young plant and ratoon cane and immediately dig out and destroy any diseased stools. In the event of any disease being found continue the inspections throughout the life of the crop.

5. Plough out ratoons in which the disease has been found immediately after the final cutting. Diseased volunteer ratoons are a serious source of infection.

6. Reduce the number of varieties grown to the absolute minimum. Variety collectors are a menace to their neighbours as well as to themselves at any time, and particularly so in the presence of this disease.

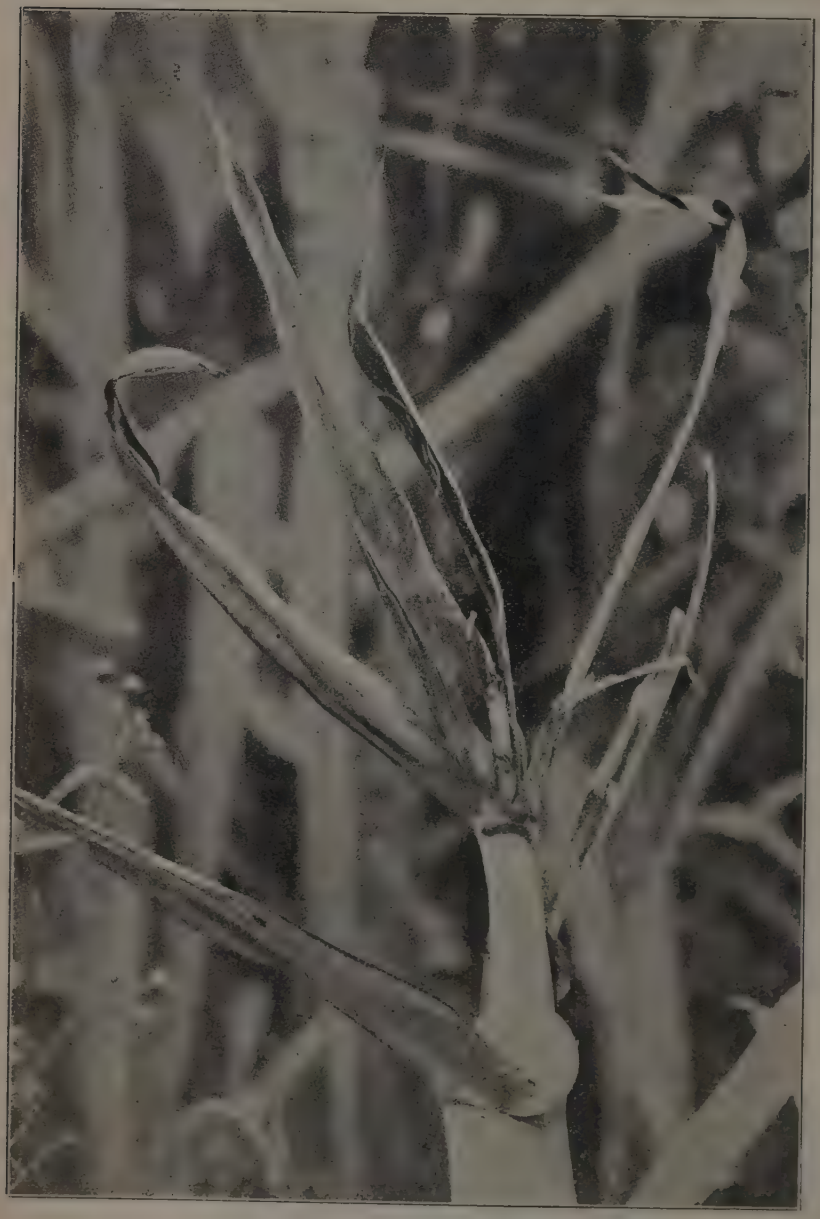

PLATE 159.
Stiff stunted leaves, typical of Fiji disease.

THE SELECTION OF PINEAPPLE PLANTING MATERIAL.

By H. K. LEWCOCK, M.Sc., B.Sc.Agr., Assistant Plant Pathologist.

SINCE the inception of the present series of pineapple disease investigations in October, 1931, attention has been chiefly centred on the problem of determining the cause or causes of "wilt" and the conditions necessary for its development. "Wilt" is widespread and increasingly destructive in pineapple fields in Queensland and is unquestionably the most serious trouble with which growers have to contend. Field studies carried out during the past twelve months have shown that wilting of pineapple plants may arise from several different causes and that the expression of disease symptoms developing in wilt-affected fields varies according to the dominant underlying cause. In fact, on the basis of symptoms developed, it has been found possible to differentiate between three distinct types of wilt occurring in Queensland plantations, namely—

(*a*) Wilt due to poor drainage or other unsuitability of the soil;

(*b*) Wilt arising from nematode attack;

(*c*) Wilt disease.

The last-named type of wilt "(*c*)" is the one which is causing most serious concern amongst pineapple growers in Queensland at the present time.

Need for Careful Selection of Planting Material Demonstrated by Spread of Wilt Disease.

During the twelve months that the present investigations have been in progress, they have contributed, among other things, a fair amount of information concerning the manner in which the wilt disease is disseminated from diseased to healthy plantations. Considerable evidence has been secured which indicates that the spread of wilt disease throughout the pineapple-growing districts of Queensland has been largely brought about through the planting of suckers, slips, and tops derived from diseased plantations. In particular, the indiscriminate planting of tops obtained free from canning factories—which has been carried on extensively in some districts during the last two or three seasons—appears to have contributed greatly to the serious position in which wilt has placed the industry in those areas at the present time.

Other Advantages Accruing from Methodical Selection of Planting Material.

While most growers are now fully alive to the importance of taking planting material only from healthy fields, it is not so generally realised that even in apparently healthy fields rigorous selection of planting material is necessary if the general standard of the plantations is to be maintained. Long-experienced growers are almost all agreed that, during the past ten years, the vitality and productiveness of Queensland pineapple plantations have shown a gradual but noticeable decline, quite apart from losses attributable to the wilt disease. This is a

matter which vitally concerns every grower, as the profitable cultivation of pineapples depends not only on the price received for the fruit, but also on the yield per acre. Costs of production remain approximately the same whether the yield per acre of marketable fruit is 100 cases or 500 cases.

In view of the present depressed state of the industry, no grower can afford to ignore any economically practicable means whereby the productiveness of his plantations may be maintained or improved. Selection of planting material on a large scale is a simple and sure method not only of ensuring disease-free stock, but also of improving the whole general standard of pineapple plantations.

Characters to be Considered in the Selection of Planting Material.

In practising selection the first task is to get clearly in mind what characters of the parent plants should be perpetuated or eliminated and, secondly, to determine if these characters are hereditary or due merely to the conditions under which the parent plants are grown.

(*a*) *Resistance to Disease.*

The foremost consideration is, of course, that the planting stock shall be free from disease when planted and possess a high degree of resistance to disease infections throughout its subsequent development. These are the criteria on which any plan or method of selection must be based. However, while the grower may practise selection primarily to secure vigorous, disease-free stock, he can, with but little additional effort, so widen the basis for selection as to include improvement of type and increased productiveness.

With regard to the fruit itself, size and shape are the most important characters to be considered.

(*b*) *Size of Fruit.*

For canning purposes, uniformly large, heavy fruit are preferred, whilst for the fresh fruit market, medium-sized fruit are in chief demand.

Only meagre data are available as to whether the size of the fruit is a persistent character. However, the evidence at hand indicates that when selecting planting material from fields where the fruit is running medium to large in size, it is advisable to avoid plants bearing undersized fruit.

(*c*) *Shape of Fruit.*

Both for canning and market purposes it is desired that the fruits should be long and cylindrical in shape, of good diameter, and possessed of flat eyes and small cores. Cone-shaped fruit are particularly unsuited for canning and abnormalities such as multiple tops also detract from the commercial value of the fruit, even when they are of fair weight. Propagation tests carried out in Hawaii indicate that the shape of the fruit is an hereditary character and plants throwing slender, conical, or misshapen fruit should be avoided when selecting planting material. On the other hand, multiple tops and prominent eyes appear to be due to environment and there is no evidence at present available which would suggest that these characters are transmitted in planting material.

(*d*) *Type of Plant Growth.*

In determining the suitability of the plant as a source of propagating material, the characters which should be looked for are:—(1) general vigour and productiveness, (2) free production of suckers, and (3) resistance to disease. All growers are agreed as to the importance of perpetuating these desirable characters in their plantations. It should be borne in mind, however, that planting material should not be selected on vegetative characters alone, as vigorous growth is no guide to the type of fruit produced and lasting benefits from selection can only come from improved yields and types of fruit.

A word of caution is necessary with regard to plants throwing an excessive number of slips around the base of the fruit. This abnormality is known in Hawaii as "Collar of slips" and all the data so far available, both locally and in Hawaii, indicate that it is an hereditary characteristic. For this reason, and irrespective of their apparent vigour, all plants throwing a "collar of slips" should be strictly avoided when selecting planting material, as such plants produce few if any suckers and the yield from subsequent crops is reduced accordingly. "Collar of slips" is an especially mischievous variation from type in that it offers an obvious and very easy source of planting material which would be seized upon by careless or inexperienced growers. However, provided that the "collar of slips" type of plant is avoided, the number of slips borne (up to half a dozen) need not be considered in selecting parents from which to take planting material.

(*e*) *Size of Planting Material.*

Tests carried out in Florida by the United States Department of Agriculture indicate that only well-developed suckers or slips should be used as planting material. Other things being equal, it has been found that large-sized suckers and slips not only produce much stronger plants than under-sized weak ones, but they are also likely to be freer from disease and come into bearing much more quickly. It is important, therefore, not to collect planting material until it has attained a fairly advanced stage of development.

The Practice of Selection.

If possible, the selection of planting material should be made only from young plants at or near the time the first fruit (plant crop) is harvested. With plants of this age it is not only easier to recognise the characters which it is desired to perpetuate, but it is also possible to ensure, with some degree of certainty, that the planting material has been derived from wilt-free stock. In any case, worn out or abandoned plantations should not be used as sources of planting material under any circumstances, as in such fields it is exceedingly difficult to distinguish between healthy and diseased plants and quite impossible to determine which plants possess desirable vegetative and fruiting characteristics. For similar reasons, the use of butts as planting material is also much to be deprecated. Furthermore, suckers and slips for planting purposes should not be taken from apparently healthy plants growing adjacent to patches affected with wilt disease, as such plants may be already infected with wilt although the symptoms are not yet evident.

Finally, growers are cautioned not to purchase suckers or slips from plantations with which they are not personally familiar unless it is known on reliable authority that such plantations are free from wilt disease. Anyone who has seen the result of planting suckers or slips taken from wilt-affected plants will not henceforth be likely to use planting material from wilt-affected fields.

In order to ensure that suckers and slips are selected only from plants which meet the desired requirements of freedom from disease, vigorous growth and free production of suckers, combined with the production of weighty, well-shaped, and uniform fruit, such plants should be marked at fruiting time by dabbing a little white paint on several of the most prominent leaves. Then, when the time comes to gather the planting material after the fruit has been harvested, all plants not so marked are rigidly rejected irrespective of their apparent vigour or the number of suckers or slips which they have produced.

In Hawaii, where tops are used extensively for planting purposes, it is the practice to select and remove these from the fruit before they are harvested. By this practice—which is possible only because of the close proximity of the Hawaiian pineapple fields to the canning factories—it is insured that all tops used for planting have been individually selected from plants and fruits of the most desirable type. Unfortunately the selection of tops in this way is not practicable under Queensland conditions, particularly during the summer months, owing to the lengthy interval which elapses between the time the fruit is harvested and its arrival at the cannery.

As previously pointed out, the indiscriminate planting of tops procured free from canning factories is a practice which cannot be too strongly condemned. In a number of instances it has been possible to definitely trace the spread of wilt disease from a field planted with tops obtained from the canning factories. While such planting material may appear to offer a cheap means of planting up an area with pineapples, it is likely to prove very costly in the long run. The origin of tops procured in this way is unknown and, quite apart from the danger of disseminating diseases, the use of such planting material should be discontinued by every grower who seeks to maintain or improve the productivity of his plantation.

Does Continued Propagation from the Same Stock Lead to Deterioration?

Many growers are under the impression that the diminution in yield and vigour of their plantations, which has become so evident during recent years, is due to their stock "running out" and that the introduction of planting material from another district will be markedly beneficial and result in greatly increased yields. On many farms the deterioration of the pineapple stock is a very serious trouble, but it has resulted not so much from continued planting of the same stock as from continued indiscriminate propagation without selection.

Methodical and persistent selection of planting material—long recognised as being most important in maintaining yields from other vegetatively-propagated crops—is just as essential in securing the best

results from pineapple-growing. Several of the most successful pineapple-growers in Queensland have been planting from the same stock for as long as thirty years, and over this period the yields obtained per acre have increased rather than diminished. These results are largely due to the discrimination exercised in the choice of planting material. The intelligent grower realises that it pays to grow nothing but the best and that to introduce planting material from an unknown source on to his farm might jeopardise the health and vigor of his own planting stock which has taken him years of effort to bring to its present state of productiveness. Instances of the calamitous results following on the introduction of diseased planting material to previously healthy plantations have occurred all too frequently in Queensland during the past few years, as many growers can testify.

The purchase of planting stock from an old-established, productive, and disease-free plantation, for the purpose of improving the type and yield of fruit grown, is a commendable practice and one likely to benefit the industry generally; but the indiscriminate planting of stock from unknown sources, frequently from abandoned or worn-out fields, is detrimental to the interests of all concerned and cannot be too strongly condemned. Undesirable types of plants and fruits are perpetuated and, what is even more serious, diseases are frequently transmitted from unhealthy parent plants to new fields. There is no doubt whatever that many of the losses and failures experienced during recent years have been due in large measure to the indiscriminate planting of suckers, slips, stumps, and tops from weak, diseased, or worn-out plants.

From the foregoing discussion it should be evident that the advantages to be derived from careful selection of planting material are not open to argument; they are real, tangible, and practicable, as Hawaiian experience has proved beyond all shadow of doubt. The direct monetary benefits likely to accrue from increased yields should alone convince all growers of the value of the practice, but the indirect benefits resulting from the stabilisation of the canning industry with a standard quality product are likely to be even greater and more far-reaching.

SILO MOULDS FOR FARMERS.

A correspondent has called our attention to the fact that the New South Wales Department of Agriculture has had made three sets of silo moulds for renting out to farmers and has suggested that the Queensland Department might do likewise.

It may interest our readers to know that this Department has for many years maintained sets of silo moulds for loan to farmers for the purpose of erecting overhead circular concrete silos. The moulds are loaned free of charge, but the borrower is required to pay all transport charges involved and to undertake the return of the moulds in good order and condition after completion of his silo.

Applications for the loan of the moulds, which are of three sizes, viz.:—14 feet, 15 feet, and 17 feet diameter respectively, should be made to the Under Secretary, Department of Agriculture and Stock, Brisbane.

COTTON PLANTING AND CULTIVATING.

By R. W. PETERS, Cotton Experimentalist.*

BOTH of these phases of cotton-growing are of the utmost importance, and, as they are usually performed by the cotton-grower, an excellent opportunity is afforded him of making a close study of the efficiency being obtained in every operation connected with them. It is suggested, therefore, that if greater attention is given to all of the factors discussed, much better stands will be obtained generally and heavier yields will be produced at a much lower cost per lb. of seed cotton.

Time of Planting.

Time of planting, in conjunction with type of soil, is, in many respects, one of the most important factors contributing to the yield obtained from a cotton plant. This is especially true in Queensland on account of the nature of the rainfall distribution and the occurrence of various insect pests.

In the main cotton-growing areas, which are in the Central and Southern districts of this State, planting should be performed following the first good rains falling after the danger of late spring frosts is passed. This conclusion has been generally arrived at in most sections of these districts, and carefully conducted time of planting tests over a series of years at the Cotton Research Station have also borne this out.

The explanation appears to be that where cotton is planted in September and October under conditions of sufficient moisture to promote steady growth, the cool night temperatures cause the plants to make mostly a slow development of the parts above ground, but a good root system, characterised by a deep growing tap-root is, however, developed. If such plants are thinned out when five or six inches tall, a stocky toughened growth develops which generally forms a splendid type of fruiting system by the time the December rains commence. The night temperatures are higher from then on, and with the ample moisture sufficient crop is usually set to prevent the plant growing too rankly or becoming so succulent as to be attractive to the corn-ear worm unless an unsuitable variety is planted on very rich soil, or prolonged rainfall is experienced in December and January. The deep-growing tap-root, on the other hand, enables the plant to carry on normally, or with only moderate checks, during dry periods in the earlier stages of growth. It is likewise of marked assistance in supplying sufficient moisture to prevent excessive shedding of the crop, reducing size of bolls, and damaging of the fibres during dry periods later in the season. In fact, in seasons in which showers occur so frequently in the spring months that a root system develops consisting mostly of laterals near the surface, rather than a tap-root with well-formed lower laterals, great loss from shedding may be experienced during heat waves later in the season.

Cotton planted late in November or in December on alluvial or sandy loams, generally receives more than ample moisture with the commencement of the wet season, which usually is around mid-December. This causes the development of an excessive lateral rooting system in the upper layers of the soil, especially if it is of a fertile nature, which

* In a radio lecture from 4QG.

results in a rank growth of plant being made that is succulent and attractive to several insect pests, and is also prone to heavy shedding of crop in either very dry or wet spells.

Where one can plant on heavy clay loams of the type usually associated with large-sized box trees, or mixtures of ironbark and box trees, such as on the lower slopes of forest country, planting can be done later than on the rich loams of the alluvial flats. Two factors may contribute to this: the plant food balances, and the mechanical condition of the soils. The heavy clay loams usually have a higher carbon-nitrogen ratio and contain much less nitrogen than do the rich alluvial loams, hence there is not such a stimulant to rank growth. Also, the clay loams probably restrict the development of the fibrous roots to a greater extent than do the loams, so that the plant does not have such a net-work feeding system to supply it nitrogen during periods favourable for the formation of the latter.

Another feature of the mechanical condition of the soils to be considered is that during periods of heavy rain, when the plant on the rich alluvial loam has every stimulant to make rank growth, the rooting system of the plant in clay and clay loam is surrounded by sodden or partially water-logged soil, which restricts not only the availability of the plant foods, but brings about a condition whereby the plants would appear to be suffering somewhat from drought, although the soils are moist. Rank growth is seldom made on such types of soil during a wet season if the right variety of cotton has been selected, unless the soils are very fertile. On the other hand, in dry seasons or during prolonged dry spells, the clay subsoils which usually accompany these soils hold the moisture up to the upper root system better than is the case with the deeper alluvial loams. It is for these reasons that it is suggested where one contemplates growing cotton, a trial should be made, if possible on some of the clay loam soils of the various types which were described in Preparation of Land, the first lecturette of this series.

Planting may also be carried out later on soil the first or second year under cultivation from the virgin state, than where it has been cultivated for several years. The most pronounced difference may be obtained, even in the same row, where a portion of the crop is on old cultivated rich alluvial loam and the rest on land of the same type, but just broken up out of the virgin state. The explanation appears again to be that a better balance of plant food exists, the newly broken country having a much higher carbon-nitrogen ratio and generally a very low nitrogen content, which condition may continue for two or three seasons, after which a rapid increase of nitrogen occurs if in a district with moderate to good rainfall.

The best time to plant in the far Northern districts depends mostly on the nature of the rainfall. In the drier inland sections or where the summer rainfall is moderate and tapers off quickly, the regular spring plantings will probably be the most suitable. In the coastal areas where very heavy rainfall is experienced, growers have found planting around the end of February gives good results, for the crop then sets and matures during the drier winter months. Growers in the Northern areas are strongly recommended to experiment with various times of planting on their different soil types, for the variable conditions make it desirable for each individual to ascertain the best for his own peculiar combination of soil and climate.

It is pointed out that in the wetter coastal portions of the Northern districts, insect attacks may be the controlling factor regarding yield to be obtained. The slightest puncture of the bolls under the conditions of high humidity in these areas, allows of the entrance of boll rots which either lower the value of the contents of the boll or destroy it entirely. Every effort should be made, therefore, to plant the cotton crop in a well-exposed position where good air drainage can be obtained, and on soils which will not force too rank a growth. This also applies to the wetter coastal areas of the Central and Southern districts.

Necessity for Good Stands.

Another most important factor in successful cotton growing is the obtaining of a full stand of plants, for no matter how suitable the land is for cotton production, or how efficient the cultural methods are, a full stand is required to produce the maximum yield that the combination of seasonal and soil conditions will allow. This is recognised in older cotton-growing countries, where heavy rates of sowing are usually made, but here in Queensland the tendency has generally been to sow just sufficient to give a good commercial strike if all conditions are favourable. This has been brought about mostly through an effort to reduce thinning charges, or to eliminate them altogether by sowing so lightly as to require no thinning.

Rate of Sowing.

The recommended seed rate of sowing is 20 lb. per acre when planting in rows 4½ feet apart. It is believed that sowing less than this is a mistake, especially in the districts where heavy storms may be experienced at planting time, or where "dry planting" is practised. Undoubtedly fairly good stands can be obtained under favourable conditions from a rate as low as 10 lb. of undelinted seed per acre, but experience has proved the advantages of planting sufficient seed to guarantee practically a full stand under almost any conditions which may occur, rather than to risk planting with lighter rates that will just give commercial strikes if everything is all right. It is also pointed out that the tendency to plant on the clay loams is becoming more pronounced each season, as cotton on these soils appears to give better average results. It is when heavy packing rains occur on such soils just before the seedlings come through that the fallacy of light planting being advisable is fully demonstrated. Under such conditions a light sowing does not supply enough seed to provide sufficient lifting power to break through the packed soil, particularly if cold soil temperatures retard growth or cause rotting of seed; whereas with a 20-lb. rate of sowing a most remarkable amount of energy is developed which, provided the field is harrowed to break the surface crust, will give fairly good chances of obtaining a stand even under rather adverse conditions. This point should be especially remembered by the growers who practise dry planting.

Where delinted seed is being planted it is possible that 12 or 15 lb. per acre is ample on most soils on account of the more even distribution that is obtained with the planter and the greater number of seed per lb. One has only to try obtaining stands suitable for experimental work, however, to realise the large amount of row space with poor stands that occurs in most commercial fields of cotton, and it is suggested that every grower check up carefully on this point to see just what results he is obtaining.

Depth of Sowing.

The correct depth of sowing varies between 1½ to 2½ inches, depending on the condition of the seed-bed, amount of moisture in the surface soils, and the method of planting. The main objective is to get a good stand as quickly as possible. This requires planting the seed just deeply enough to have sufficient moisture to germinate them, and still not have the soil dry out before the young roots penetrate into the moist subsoils. For most soils under average conditions a depth of about 2 inches in moist, firm soil will allow of a good germination being obtained. This is especially true if a split-wheel type of planter is used. Where the seed is covered with scrapers, or by scufflers if planted in shallow furrows, 2½ inches will probably be better, as the soil is not compact and there is danger of the moisture being lost before germination is affected, particularly if drying winds are experienced.

If plantings are made at a greater depth than 2½ inches there is always danger of the seed rotting in a cold wet spring, and in a dry spring, while germinations may be obtained, the seedlings are frequently so long in coming through the surface that they are thin and spindly and of a pale yellowish colour rather than the usual healthy green. Such weakened seedlings are likely to be attacked by pests and diseases if wet weather is experienced, and may dry out if hot, dry winds prevail for any length of time. Generally speaking, the tendency is to plant too deeply, especially in the plantings in September, when the soil temperatures necessitate quick germination and appearance of the seedlings above ground.

Methods of Sowing.

There are several methods of sowing cotton seed being used in this State, all of which give good results when favourable conditions exist. With the exception of very large acreages, it is believed, however, that for most soils and conditions planting with a split wheel type of planter equipped with disc openers, after good rains have fallen, will give the best results. Where a seed-bed has been prepared properly and sufficiently early to store up any rain occurring during the winter months, planting with this type of planter after a fall of around an inch of rain, should give a perfect strike which can be maintained for some time without additional moisture being required. The advantage of using such a method of planting is that the disc openers push aside any crusts and the dry surface soils, thus distributing the seed at a uniform depth in moist, mellow earth which is packed firmly around them with a side pressure by the halves of the split wheels, and yet leaves a fine mulch on top of the seed. This packing effect tends to lift the ground moisture to the seed, thus ensuring ample to germinate them even if drying winds are experienced, while the mulch on top prevents excessive evaporation.

The same type of planter is excellently suited for planting seed in the dry soil, which practice is followed mostly by growers with large acreages. The system of dry planting has merits undoubtedly, where a large acreage has to be sown, but there are drawbacks as well. In springs when light showers are experienced much replanting has to be done, for the seed germinate and then either fail to come through the ground, or die off if no further rains occur in time to establish the rootlets in the subsoil moisture. This is especially true on land just broken up from the virgin state. It is recognised that a grower with

limited labour who intends planting a large area is faced with the necessity of dry planting to some extent in order to get his entire acreage sown on the first good rains in an average season. It is suggested, however, that only that portion of the acreage should be dry planted which experience indicates necessary to enable getting the whole crop sown in time to have all of it in ample moisture to give good germination.

There is always danger of the first planting rains being heavy storms, and where dry planting has been done on clay or clay loams, a crust is likely to be formed, which may greatly affect the germination and allow of only a patchy irregular stand being obtained, even if the field is well harrowed after the rain.

Many growers of small acreages in the older agricultural districts, who have maize planters unsuited for planting undelinted cotton seed, have adopted the practice of opening shallow furrows, sowing the seed by hand and then covering with either a harrow or scuffler. This system undoubtedly causes loss of moisture and undoes the benefit obtained from early preparation of the seed-bed. It is suggested, now that delinted seed can be obtained, that where an ordinary one or two row maize planter is available, the plates be modified to make them suitable for planting cotton seed. This can be done by enlarging the holes in the eight-holed plates and adjusting the gears to allow of greater rate of seeding.

The providing of delinted seed should prove of great assistance to the growers in the newly burned scrub areas, for it will eliminate the necessity of treating the seed to make it suitable for using in the "walking stick" hand planters. There may be some danger, however, of planting the delinted seed in the dry ash before the planting rains occur on account of the delinted seed germinating with less rainfall than would be the case with treated seed, hence in a spring experiencing light showery conditions, considerable replanting might be necessary. It is suggested, therefore, that a grower plant only a portion of his scrub acreage in the dry ash until sufficient experience has been obtained to demonstrate the degree of danger associated with such a practice in each type of scrub.

Spacing of Rows.

A spacing of 4½ feet between the rows is generally used in all of the cotton-growing areas. During the early stages of this present phase of cotton-growing, widths varying from 3½ to 5½ feet were used, but experiments and the general experiences of growers indicate that around 4½ feet appears to be a fairly good row spacing for most soils over a series of seasons. It is possible, however, that where cotton is being grown on the clay loam forest slopes away from the immediate coastal areas, a spacing of 4 feet or 4 feet 3 inches may be suitable. Usually the plants do not grow so tall on such soils as on the alluvial soils, hence ample sunlight and air drainage may be obtained with the slightly closer distances.

It is not recommended that spacings smaller than these be tried, for with heavy rainfall accompanied by prolonged cloudy weather in February, there is grave danger of sufficiently succulent growth being made to create dense shade. Experiences of past seasons have indicated that such conditions are conducive to insect attacks, accompanied by heavy losses from boll rots on the lower portions of the plants.

Cultivating.

It is strongly recommended that more attention should be paid to the cultivation of the cotton crops during the early stages of growth. The general tendency is to wait until the plants are well developed towards the thinning stage before the first cultivation is made. In many cases considerable growth of pigweeds and summer grass will be present by then, especially in a season with early showers, and it will be nearly impossible to destroy all of such growth without hand labour, even with the most efficient cultivators. This not only increases the cost of production needlessly, but where only light rainfall has been experienced, moisture has been robbed from the soil around the plants which should have been conserved by careful mulching and clean cultivation. The practice at the Cotton Research Station is to cultivate as soon as the seedlings are 2 or 3 inches high, using tines 2¼ inches wide, with guards to prevent the soil covering the plants. This eradicates all weed and grass seedlings and establishes a nice mulch around the plants, which helps to reduce evaporation and prevents the growth of weeds in the row. If further rainfall is experienced before thinning time, it will be necessary to cultivate again, otherwise this can be avoided until the thinning is done. A careful cultivation is given after this operation to re-establish the mulch between the rows and around the plants. This should be done as quickly as possible after the thinning, on account of the removal of most of the mulch in the row during the thinning operations.

PLATE 160.

Illustrating when the first cultivation of cotton should be made. The plants in the foreground were young velvet beans, which are very brittle, yet with the equipment being used no damage was done to them. The soil in which they were growing is of a clayey nature, and the cultivating was done three days after a hard rain.

Generally speaking, not more than three or four cultivations should be required after the one immediately following thinning. At each of these operations it is recommended that the soil be worked around the plants, for not only does this control most of the weed and grass growth and greatly reduce the evaporation, but a firm brace is established around the plants which helps to prevent them being blown over during severe storms when the soil is wet.

It is suggested that greater efficiency should be obtained in the cultivation operations. For most districts it is recommended that the best work can be done with the two-row cultivator of the type where the driver steers the carriage on which the tines are fastened, with his feet, rather than by depending entirely on guiding the horses. There are several makes of this type of machine on the market, all of which can be equipped with tines, sweeps, duck feet, and in some cases discs. By using such a type of machine, not only can better work be done close to the plants, thereby avoiding the necessity of much hand hoeing of the crop, but a greater acreage can be cultivated in a day, thus reducing the cost of production in two ways.

In conclusion, it is advised that the advantages gained through obtaining an early stand of cotton are ordinarily so great that every precaution should be taken to maintain one. It is recommended, therefore, that each grower obtain a supply of ingredients for making poisoned baits, before he plants. Every season a considerable number of growers experience severe losses through cutworms and false wire worms attacking their cotton crops when in the seedling stage. Both of these pests are night feeders, and by spreading poisoned baits amongst the plants around and in the affected areas as soon as possible after the attack first occurs, an efficient control can be quickly and cheaply effected.

A suitable bait can be made by thoroughly mixing 25 lb. bran and 1 lb. Paris green together in the dry state, then adding 1 quart of molasses and just sufficient water to make the bait moist and crumbly. As this bait is very poisonous, it should be kept away from poultry and live stock.

THE PREMIER AS A GARDENER.

The Premier (Mr. W. Forgan Smith), in opening the Spring Show of the Horticultural Society of Queensland at the Albert Hall, said: "Anyone who is a gardener must have an appreciation of nature and possess a love of beauty." He revealed that he was an enthusiastic gardener, having in his boyhood been trained to a thorough appreciation of the scientific side of the work by his father, who was a professional horticulturist. Mr. Forgan Smith recalled how he used to assist his father to prepare horticultural exhibits for some of the biggest flower shows held in Great Britain, and their sense of satisfaction at frequent success. As a result of those experiences, he said, he knew full well the wealth of painstaking care that had been bestowed on the magnificent exhibits entered in that afternoon's show. Referring to the success of gardeners in improving and developing varieties of flowers by hybridisation and other scientific methods, the Premier said that there should be ample opportunity for Queensland horticulturists to develop an export trade in flower seeds, which, no doubt, would be eagerly sought by gardeners in other parts of the world.

COTTON THINNING AND SPACING.

By R. W. PETERS, Cotton Experimentalist.*

THE subject for the fourth lecturette of the present series on cotton-growing is cotton-thinning and spacing.

There is a decided tendency amongst many cotton-growers in Queensland to omit thinning their crop. This has been brought about in an attempt to reduce cost of production, especially with growers of the larger acreages, and also through a certain amount of propaganda, which has been based on the results secured in parts of the United States rather than on any extensive experimental data obtained here. It is unfortunate that there is this tendency, for, generally speaking, it is extremely doubtful if growers can afford not to thin.

Before discussing the merits of thinning in this State, it may be advisable to explain briefly the conditions in the cotton-growing areas of the United States, where close spacing or no thinning at all has come into prominence in recent years. In the first place, prior to the advent of the boll weevil, close spacing was seldom tried, and the average yield per acre was higher than since the boll weevil arrived and close spacing has been practised. The fifteen-year average prior to when the boll weevil first caused such serious damage in the wetter Eastern States was 185 lb. of lint cotton per acre, as compared with 158 lb. for the fifteen-year period following that, and 159 lb. for the last ten-year period when closer spacing and dusting for the weevil has been more widely practised, and also varieties with higher lint percentages have been grown. It is significant in this respect, that experiments in recent years on the richer soils in the districts with mid-seasonal rainfall more comparable to that of Queensland, have frequently yielded results in favour of the 20 to 24 in. spacings. Undoubtedly, the boll weevil is the major factor controlling yields to be obtained in much of the rainfall-grown cotton belt, hence any method which combats it successfully is the most profitable one. This has been brought out clearly by H. B. Brown, the noted American cotton investigator, when, in giving a resumé of row and plant spacing tests before the advent of the boll weevil, stated as follows:—

"On the less fertile land the closer spacing gave yields in the majority of cases; on the rich lands wide spacing gave best yields in a number of cases, but the results varied widely, due probably to differences in rainfall, length of fruiting season, &c. Prior to the coming of the boll weevil the fruiting season of the cotton plant was long in most parts of the cotton belt, and there was enough time for plants to grow large and utilise much space. It did not matter if the plants were not close together. With time, especially on rich soil, they grew large and used all the space available. Under such conditions wide spacing frequently gave good returns. With heavy weevil infestation, however, the fruit must be set in a very short time, say, a month or less. This makes it necessary for more plants to be left on the land if all the space is to be used to the best advantage."

Discussing the results obtained from spacing tests under weevil conditions, he stated that "it seems on poor land, both with and without weevils, cotton should be spaced closely, say, two to four plants per hill,

* In a radio lecture from 4QG.

with hills 10 to 12 in. apart in rows 3 ft. wide. On medium rich to rich soils it is easily possible to get cotton spaced too closely if weevils are not present, say, two stalks in a hill closer than 12 in. in 3½-ft. rows." He also recognised that varietal differences in habit of growth affect the spacing, and stated: "It stands to reason, however, that a vigorous, rank growing variety will be able to use to advantage more space than a weaker, smaller growing variety. In cases of rank foliage, crowding the plants may result in much boll rot during rainy seasons. The dense shade produced is favourable for fungus growth on the bolls."

American Soil and Climatic Conditions.

Now these results have been obtained under soil and climatic conditions much more favourable for close spacing of plants and rows than is the case in most of the cotton areas in Queensland.

In the first place, much of the cotton areas of the United States where heavy mid-seasonal rainfall is experienced have been farmed mostly with cotton for many years, which has resulted in the fertility of the soil being greatly depleted. In fact, applications of as heavy as 1,000 to 1,200 lb. per acre of fertilizers containing heavy amounts of growth-producing plant foods are recommended for portions of these districts, which indicates how poor they are. As fertilizing is carried out to a large extent, it can be realised that leaving many of such small plants as would be grown under such conditions naturally should return the most cotton per acre.

Likewise the rainfall is generally suitable for close spacing all over the American cotton belt. Frequently preparation of the seed bed is delayed on account of the wet soils, and often planting is held up for the same reason. The plants usually start off, therefore, with ample moisture in the soil, and leaving them close together under such conditions does not cause any severe checking of growth or shedding. The mid-seasonal rainfall is also usually suitable for closer spacing, so that the closely-spaced plants on the poorer to medium soils really do not give such a crowded appearance as is the case here.

Queensland Conditions.

The conditions which have just been lightly touched upon are in marked contrast to those generally ruling in most of the cotton areas in Queensland. Usually the crop is planted following storms, which often do not wet the soil to any marked depth. Long dry periods may follow the germination of the seed, and seedling growth is frequently very slow, and, in some seasons, badly checked to the point of loss of stand occurring unless thinning is done early to reduce competition for what moisture is present. With the starting of the wet season entirely different conditions may exist and much heavier rainfall occurs during December, January, and February than is generally the case in the corresponding period of plant growth in most of the American cotton centres. Likewise most of the Queensland cotton soils are much richer than those of the American cotton belt, many soil analyses having shown high amounts of nitrogen for cotton-growing under such mid-seasonal rainfall as is frequently experienced here. It can be realised, therefore, that methods of cotton culture successful under American conditions may have but little value in much of the Queensland cotton districts.

Results from Queensland Spacing Tests.

The ascertaining of the most suitable plant and row spacings under Queensland conditions has not been as comprehensive as desired. The growers have mostly been divided into two schools of thought—little or no thinning, and spacing out to 20 to 24 inches apart at various heights of the plants. This has made it most difficult to arouse interest in thinning tests, with the result that most of the data has been obtained from tests carried out on different experiment stations. Climatic variations, severe attacks from migrations of corn-ear worm, and soil inequalities have affected the results there, so that the data obtained has not given any actual consistent clear-cut indication of the relative merits of the spacings tried out.

Generally speaking, however, the results have been in keeping with many observations made over several years on most of the types of soils on which cotton is grown in this State. These have indicated that in seasons of good spring rains and sufficient rainfall to promote steady but not luxuriant plant growth during the critical period of fruit formation, spacing singly a foot apart, or on some of the less fertile soils, no thinning, if a light seeding has been used, may give excellent yields; likewise so will 18 to 24 inch single spacing, if the plants are thinned when 6 to 8 inches tall. In dry springs, however, or when good early rains occur and then droughty conditions are experienced in mid-season, much greater shedding of flower buds and young bolls takes place in the closer spacings than where the plants are left singly 20 to 24 inches apart.

In the spacing experiments carried out at the Cotton Research Station, the closer spacings have always given greater flower production during the first half of the season, but in only one season has this gain been of benefit in the final yield obtained. This was in the 1927-28 crop, when climatic conditions were almost ideal during the growing season, as indicated by the exceptionally good yields obtained all through the district. On the Research Station the plot yields ranged mostly from 12 to 1,600 lb. of seed cotton per acre, which included many kinds of experiments. In this season 12-inch spacing in rows 4 feet apart gave the highest yield of the experiment, and the same spacing was the best where the rows were 4½ and 5 feet apart.

These results were in marked contrast to those obtained in the following season, which experienced extremely dry conditions in January. In the similar experiment of that season, the 12-inch spaced plants showed the effect of the different heat waves more than either the 24 or 36 inch spacings in all row widths. Although the flower counts were in favour of the closest spacing they really portrayed the drought effect rather than indicating heavier yielding, for the wider spacing were really benefited by the dry spells.

Similar results were likewise obtained in 1929-30, when another severe heat wave was experienced in January and extremely dry conditions ruled during March and April. The following brief notes describe the plant growth of the different spacings:—

"Unthinned—small crowded, whip-like plants carrying a few bolls which were mostly on the outer fruiting branches of the vegetative branches. The bolls were generally smaller than those of 2 feet single

spaced plants, apparently being checked by lack of moisture. With heavy rainfall in February probably a rank growth of plant would have developed.

Two-foot bunches (representing thinning by blocking out bunches containing one to three or four plants per hill. This closely resembles the American method—only 1 foot spacing is used there on most soils) —plants small and obviously crowded, bolls borne only on the outer fruiting branches of the vegetative branches.

Two-foot single spacing—Around 3 feet tall with a good scattering of bolls throughout the plant. Could have developed taller without undue crowding.

Inspection of the rooting systems of the different treatments in this experiment showed a less vigorous general root system on the unthinned and 2-feet bunches plants which would explain the lack of resistance to heat waves in these treatments.

Somewhat similar results were obtained in spacing tests carried out at the Experiment Station at Home Hill in the season 1923-24 and 1924-25. In the first, which was a dry one, the 24-inch spacing gave better yields than either 6, 12, or 18 inches in row spacings of 3 feet 6 inches, 4 feet, 4 feet 6 inches, and 5 feet, with the exception of the 4 feet rows, where irregular stands may have made it second highest, the 18-inch spacing being the best. In the following season, which was a wet one, the 6-inch spacing was the best for the three smallest row widths, while the 24-inch was the best in the 5 feet, the 6 inches in the 3½ feet rows, giving the highest yield of the experiment—950 lb. seed cotton per acre.

Height of Thinning.

Tests have been carried out over several seasons at the Cotton Research Station to determine the effect of thinning the plants when they were at different heights. Somewhat fluctuating results have been obtained from season to season, but generally it can be stated that thinning when the plants are from 6 to 8 inches tall gives better results than when they are taller. Apparently the early thinning is conducive to the formation of fruiting branches low on the plant, which allows of early flowering, setting, and maturing of the crop. Indications were also obtained that there is a tendency to produce more 5-locked bolls, thus increasing the average weight of boll per plant.

Summary.

It is strongly suggested that each grower experiment on his own soils to ascertain the best spacing of plants. The Department will be only too pleased to assist growers to carry out tests wherever possible. Where growers have obtained satisfactory yields with spacings around 2 feet, it is suggested they continue using the same until accurate experiments on their soils demonstrate other spacings are more suitable.

Where a grower has been leaving his plants spaced closely, it is strongly suggested that he experiment also with wider spacings, for it has not been proved that leaving plants unthinned or closely spaced is profitable on the average soils of the Queensland cotton areas. Undoubtedly during the droughty conditions of the 1930-31 and 1931-32

crops, serious losses occurred in many instances through leaving the plants closely spaced or unthinned. This was amply demonstrated in several districts where 2-feet spaced crops yielded well, while adjacent unthinned or closely spaced crops were absolute failures. Where thinning is done, endeavour to complete the operation before the plants are over 8 inches tall. It is easier to chop them out before they reach this height, and extra assistance may be given the plant by the early thinning, especially in dry springs. Chop the plants just at the surface of the ground; this takes less effort and removes any young weed or grass growth in the row with the same stroke that destroys the plants. This also prevents a slicing stroke of the hoe which would cut off the plants above the seed leaves, and allow them to grow again. Keep the field clean before thinning time, and use a light, sharp hoe with the handle adjusted to suit the operator, the goose neck garden hoe being preferable to the heavy type of chipping eye hoe. Greater efficiency can thus be obtained, and a larger acreage can be thinned in a day, with a resultant lowering in the cost of production.

THE JOURNAL IN PARLIAMENT.

In the course of the debate on Supply in the Legislative Assembly several references were made to the value of the Journal, and from which the subjoined extracts are taken:—

"The 'Queensland Agricultural Journal' is a very valuable publication so far as agriculturists are concerned. The Journal goes into many unsuspected places; and it has the unique feature that the tribute can be paid that every officer of the Department is anxious to give of his best in contributions to that Journal, which . . . is a very potent force in the agricultural life of the State."—Hon. Frank W. Bulcock (Barcoo).

"The 'Queensland Agricultural Journal' is of great assistance to agriculturists, and is eagerly sought by them."—Mr. V. H. Tozer, M.L.A. (Gympie).

"The Journal is a very fine publication, it does splendid work, and is one which considerably assists the primary producer. In the southern districts which I know very well . . . the Agricultural Journal is in great demand."—Mr. W. J. Copley, M.L.A. (Bulimba).

"I would like to say that the 'Queensland Agricultural Journal' is . . . altogether a very fine production."—Mr. T. L. Williams, M.L.A. (Port Curtis).

"The 'Queensland Agricultural Journal' is also doing good work, and is much appreciated by the agriculturists of the State."—Mr. E. H. C. Clayton, M.L.A. (Wide Bay).

"The 'Queensland Agricultural Journal' compares favourably with similar publications in the other States of Australia and in other countries, both as regards the information it contains and its appearance. The Journal is of extreme value to the producer by reasons of its excellent photographs and scientific illustrations. . . . I hope the producers will realise the advantage of the 'Queensland Agricultural Journal' and will become subscribers to it."—Mr. G. F. R. Nicklin, M.L.A. (Murrumba).

SHEEP PARASITES AND DISEASES.

By J. CAREW, Senior Instructor in Sheep and Wool.

QUEENSLAND, like all other countries, has its share of parasites and diseases; still, generally speaking, the sheep of this State are singularly healthy.

With the exception of the blowfly and wild dogs, a considerable area of the western portion of the State is free from parasites, disease, and pests, while in other vast adjoining areas, they are easily controlled.

Considering that nearly all the complaints which affect our sheep can be controlled successfully by cleanliness, dipping, and drenching, it is remarkable that a greater effort is not made by our sheep farmers generally to free both flocks and pastures of at least some of the diseases and pests.

One parasite which is responsible for the most loss, especially in coastal, semi-coastal and plateau areas in Queensland is the stomach worm (*Hæmonchus* or *Strongylus contortus*), and as this can be controlled, if not totally eradicated, by systematic drenching and good management, a worthy effort should be made to free not only the sheep but the pastures from this pest.

Drenching to save the life of the sheep is not sufficient, but an effort should be made to maintain them in full health and vigour. A worm-infested ewe cannot rear a vigorous lamb. An unthrifty lamb cannot develop into a good sheep, and will be too weak in constitution to resist successfully worm infestation.

By controlling stomach worms many other internal parasites are held in check, such as the lung and nodule worms. No doubt each year is claiming either an increase in the number of parasites or a greater spread of those in existence here.

To control the spread of both parasites and disease among stock is of vital importance, not only to those concerned in the sheep and wool industry, but to the welfare of the State in general.

Lice in Sheep (*Trichodectes sphearocephalus*).

This parasite is a louse common to Queensland and is responsible for a far greater loss both in wool and flesh than is usually realised.

Fortunately they can be got rid of completely by dipping, but in spite of this fact they are spreading considerably in Queensland. This insect does not leave its host unless to transfer itself to another sheep which it does quickly if conditions, especially after shearing, are favourable. Besides the loss of wool from biting and scratching, there are portions of the fleece that become thin and ropey, which affects the actual market price. When wool is rubbed off on stumps, fences, or otherwise, it is possible that lice will be adhering to it, thus providing another means of fresh infestation. Lice live on the wool close to the skin and cause considerable irritation. If lambs are running with lousy ewes they will soon become infested, especially after shearing. Owing to the skin of lambs being more tender, they suffer to a greater extent from lice than adult sheep. The irritation that is set up and the discomfort caused interferes with the nervous system and feeding, thus retarding that growth and development of lambs so important in their early life.

Treatment.

Dipping in one of the well-recognised proprietary poisonous dips, preferably the arsenical powder dips, is the most effective treatment.

The best time to dip is from four to five weeks after shearing. This gives the cuts ample time to heal, the skin to become normal, and the growth of wool sufficiently long to hold the dip, still allowing the mixture to penetrate to the skin without lengthy immersion. One dipping in a poisonous powder dip that adheres well to the wool may free and keep the sheep free from lice from shearing to shearing, as sufficient of the poison is held in the wool to destroy the young lice that hatch out after being dipped.

Dipping does not destroy the nits or prevent them from hatching out, but they are easily killed when they first emerge from the egg.

A home-made dip mixture can be made by using 2 lb. arsenic, 2 lb. carbonate soda, to 100 gallons of water. The ingredients should be first boiled in a smaller quantity of water until thoroughly dissolved, then diluted to the proper strength. With this mixture as well as with other dips which do not adhere to the wool for a lengthy period, it is best to give two dippings at intervals of two weeks. When

dipping to control lice it is better to dip the whole of the flock at the same time. If the wool is at half length the mixture should be weakened and the sheep immersed until saturated to the skin.

Care in Dipping.

Sheep should be handled carefully throughout the whole dipping operation. The mixture should be correct and well stirred up. Extremes in temperatures should be avoided. The sheep should not be overheated or thirsty when being put through the dip. Do not crowd sheep into the draining pens, as scalding may result. Sheep should be allowed access to a shaded enclosure after draining, and not allowed over their pasture until fairly dry. Avoid driving for a few hours after dipping, and then as quietly as possible.

Rain soon after dipping may cause scalding by carrying some of the mixture to the skin, or some of it may be washed off on to the pasture and cause poisoning.

The Sheep Tick or Louse Fly (*Melophagus ovinus*).

This parasite causes considerable discomfort to sheep, especially if present in large numbers.

When ticky sheep are shorn and the wool pressed, the ticks cause a stain in the wool which is very objectionable and will cause a decline in the value of wool.

Two dippings, as recommended for controlling sheep lice, will free the sheep of this parasite.

The first dipping should take place from three to six weeks after shearing.

Scrub Ticks (*Ixodes holocyclus*).

Sheep running on scrub lands partly cleared within a limited distance from the coast, probably 150 miles, are liable to attack. This is one of the worst external parasites, as they set up a paralysis which lasts for eight or ten days, and in most cases prove fatal.

Prevention is recommended by a thorough clean-up of all scrub lands to which sheep have access, and the burning of all dead grass.

Treatment.

Dissolve 9 grains of Trypan Blue per 1 fluid oz. of water. As the solution cools a sediment falls which is removed by filtering it through a funnel in which is placed a properly folded filter paper or a piece of clean fine linen. This solution is then injected under the skin by means of a thoroughly sterilised hypodermic syringe.

Dose: One tablespoon for lambs. Increase the dose in keeping with size and age of sheep to five tablespoons. A second dose may be given twelve hours later, if necessary.

Sucking Sheep Louse (*Linogthanous ovillus*).

This parasite has been found in a few places in Queensland distant from each other. Where present, they cause much damage to the wool, leaving it spongy, devoid of yolk, and in a very mushy condition.

Stomach Worms (*Strongylus or Haemonchus contortus*).

Scientists agree that they have worked out the life history of these worms, which is a big advantage in controlling them.

When stomach worms are known to be in the pasture we cannot afford to neglect the sheep, especially if weaners are amongst them. The conditions suitable for worms to develop is when the weather is warm and the soil and grass moist. Under these same conditions grass will grow quickly and give a good nutritious food in abundance.

Sheep will take in worms if on the grass, but may not show any evil effects while the pasture is good.

The worms should be expelled from the sheep before they commence to lay eggs, which they do in large numbers, thereby contaminating the pasture while the sheep are still looking healthy. Drenching is sure to diminish the number of worms, but it may take more than one drench to completely eradicate all of them. (Plates 161-162.)

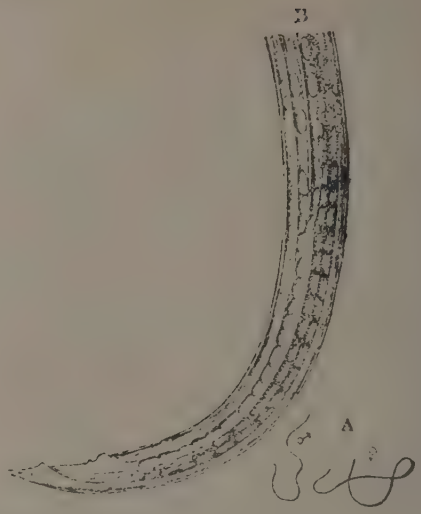

PLATE 161.

STRONGYLUS RUFESCENS.

Caudal extremity of the male; magnified 100 diameters.—*Railliet.*

STRONGYLUS RUFESCENS.

Found in air passages of sheep and goats.

a—Male and female; natural size.

b—Caudal extremity of the female; magfied 50 diameters.—*Railliet.*

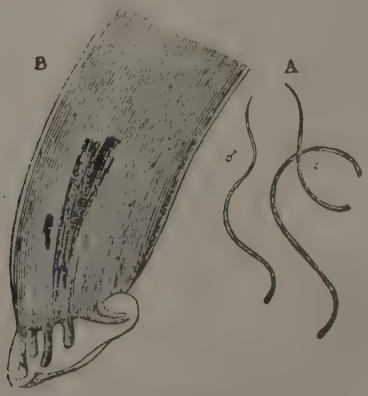

PLATE 162.

STRONGYLUS MIRCURIS.

Found in air passages of calves and older cattle.

a—Male and female; natural size.

b—Caudal extremity of the male; magnified 100 diameters.—*Railliet.*

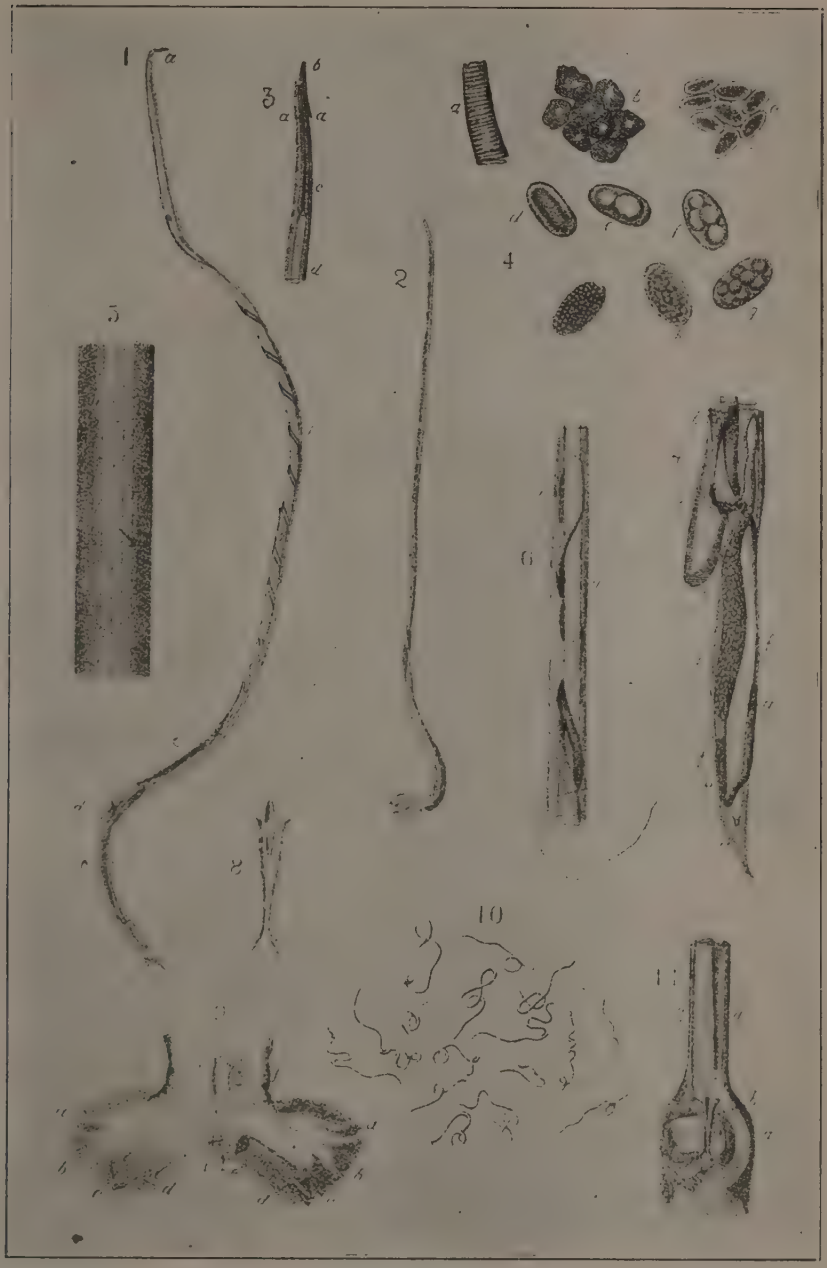

PLATE 163.

STRONGYLUS CONTORTUS (The Twisted Stomach-worm).

Cooper Curtice, D.V.S., M.D.]

DESCRIPTION OF PLATE 163.

Strongylus contortus.

FIG. 1.—Adult female magnified six times: *a*, head; *b*, ovaries wound around intestines; *d*, papillæ.

FIG. 2.—Adult male magnified six times.

FIG. 3.—Head: *a*, two-barbed Papillæ.

FIG. 4.—Eggs highly magnified: *a*, *b*, *c*, *d*, *e*, *f*, *g*, *h*, different stages of development; *i*, egg as it is laid.

FIG. 5.—Skin showing nine of eighteen longitudinal lines.

FIG. 6.—Portion of female: *a*, intestines, *b*, *b*, end of ovary.

FIG. 7.—Caudal end of female: *a*, vulva, *b*, *c*, vagina; *d*, *d*, uteri filled with eggs; *e*, oviduct; *f*, *f*, ovary; *g*, intestines.

FIG. 8.—Spicula, enlarged.

FIG. 9.—Bursa expanded to show costæ.

FIG. 10.—Group of males and females; natural size.

FIG. 11.—Caudal end of male: *a*, bursa; *b*, spicula; *c*, seminal reservoir; *d*, intestine.

Should the sheep be allowed to run on the same pasture they were grazing on before drenching, and which was allowed to become contaminated, it stands to reason that, although the worms have been eradicated from the sheep they will soon become re-infested.

This fresh infestation continues during the time the embryos remain alive on the grass which the sheep consume.

As long as this supply continues, drenching the sheep is necessary to enable them to resist the fresh attack. Should weaners be in the flock where the infestation of worms is serious, their constitution is bound to suffer to a greater extent than grown sheep, consequently they take longer to return to normal.

When introducing sheep to country free from worms, care should be taken that they receive two good drenches at intervals of eight days. While waiting for the second drench they should be placed in a small paddock that can be ploughed immediately after they are taken out. This precaution is necessary, for although the first drench may kill all the worms (which is not likely), the eggs may still remain. If the sheep are confined to a given area all eggs will be excreted, and unless the embryos gain access to grass they perish. Ploughing the land and bringing it into thorough cultivation destroys the worm. If the sheep are allowed to roam over the pasture soon after drenching with sufficient heat and moisture present, the eggs hatch out within a few days and live on the organic matter contained in the droppings, after which they moult and attach themselves to a blade of grass where they develop a protective covering and await the host.

The eggs will not hatch out at a low temperature or under dry conditions, but remain in a dormant state for several months. After attaching themselves to the grass they are capable of remaining in the ensheathed stage for at least six months, as reported by Sir Arnold Theiler as the result of his investigations in South Africa.

Many well-known helminthologists agree that by withholding ruminating animals from a pasture for twelve months it can be entirely freed from worms, also that they will not reappear unless introduced by a worm-infested ruminant (sheep, goats, or cattle).

Sheep, like other ruminating animals, have four stomachs, first the paunch or rumen, where the rough food is conveyed and held until brought up in the form of balls, thoroughly masticated, and returned to the second stomach or reticulum.

It is then passed through the third stomach, the omasum or bible, to the fourth or true stomach, the abomasum, which digests and commences the assimilation of the food. It is here that the stomach worms are to be found. The numbers present indicate the severity of the attack.

Symptoms.

If worms are present in small numbers little or no indication of their presence can be discerned.

While the food is sufficiently good to make enough blood for the sheep after the worms are satisfied, no evil effects are shown.

When the nutritive value of the food diminishes the worms get first share of blood, leaving the sheep with an insufficient supply. When this stage is reached the quantity and value of the food decide the amount of blood that is made, while the number of worms determine the length of time the sheep can withstand the attack without showing the evil effects.

Pale skin denotes the want of blood. This is most noticeable about the face, eyes, and lips. The sheep become sluggish, which denotes a derangement of the digestive organs followed by continued scouring, an abnormal thirst followed by bottle (a swelling under the jaws), and general debility.

Great care must be exercised when driving sheep in this state, as if forced and overheated they are likely to die, especially if in fat condition. When forced they usually lie down flat on their bellies with their legs tucked in under them. They then stretch their heads out, resting the bottom of their necks on the ground.

Treatment.

According to the recommendations of such men as Sir A. Theiler, Chief Veterinary Director, South Africa, Mr. I. F. Craig, M.A., M.R.C.V.S., and Mr. A. H. Cory, M.R.C.V.S., Chief Inspector of Stock, Queensland, all agree that the first object of all treatment of disease is in removing the cause. In this case the removal of worms should be brought about by anthelmenties. This method has been well supported in many experiments carried out in Australia by such prominent men as H. R. Seddon, D.V.Sc., and I. Clunies Ross, D.V.Sc., at Glenfield Veterinary Research Station, New South Wales, where a large number of drugs were used. These were reduced to four. In coming to this decision they state in their conclusions, Veterinary Research Report, 1927-28, page 81: "From the foregoing it would appear that the most useful methods are—(*a*) copper sulphate, (*b*) copper sulphate and mustard, (*c*) carbon tetrachloride, and (*d*) tetrachlorethylene. The results in brief against *Hæmonchus* (*Strongylus*) *contortus* in the case of carbon tetrachloride showed considerable variation, generally good. The dose of copper sulphate (which from a general review of the results should be combined with mustard) might commence with a dose of 1¼ grains for lambs, say 30 to 40 lb. in weight, and be increased proportionately for sheep of greater weight. The therapeutic dose of tetrachlorethylene appears to be 2½ to 5 c.c., and gives generally satisfactory results against *Hæmonchus contortus*. As against the Trichostrongyles, the results with tetrachlorethylene appeared less satisfactory, and against this parasite were not as good as against *H. contortus*. Comparing now these treatments of parasitic gastritis, one may conclude—(*a*) that copper sulphate and mustard and carbon tetrachloride are both good methods of treatment, and efficiency of about 75 per cent. and upwards may be obtained as a routine with suitable dosage. Even with large doses, however, there is liable to be variation amongst animals given the same dose. (*f*) It must be borne in mind that the best results wih copper sulphate and mustard appear to be gained by starving animals before treatment. With carbon tetrachloride, on the other hand, no such preparation is necessary. (*g*) As to the relative safety, there is no question but that copper sulphate and mustard is the safer drench."

These conclusions are much in keeping with the results secured in my tests at Milmerran and Yeerongpilly in 1929. The addition of bluestone to the arsenic and epsom salts formula proved equal to the bluestone and mustard for stomach worms, and more satisfactory in connection with the control of the Nodule Worm. Since these tests were completed it has been decided to reduce the amount of bluestone to 4 oz. when being used in conjunction with the arsenic-epsom salts formula.

The amount of food available at the time the drenching is to take place should to a great extent decide the length of time to starve the sheep before drenching. When grass in the pasture is scarce, short, and dry, they may be kept away from water only.

Where worms are known to exist the drenching should be regular and administered before acute symptoms set in.

Ewes rearing lambs should be kept as free as possible from worms, as, if badly infested, their milk supply is the first to diminish. This causes the lambs to take to the grass with which they consume worms from which they soon become unthrifty and anaemic.

Drenching under the most favourable circumstances necessitates a considerable amount of extra work and expense, as well as being hard on the sheep. If they are wormy and given a good drench they improve quickly, but if given a drench that will not kill even the worms in the fourth stomach much work and expense is incurred without securing any benefit.

This year (1932) heavy losses have been reported after drenching with carbon tetrachloride. As practically all losses were among sheep running on light forest or traprock country, it would appear that the losses were brought about by a mineral deficiency. Should a deficiency be known to exist, this drug should be substituted by one of the other drenches recommended, or the sheep allowed free access to a good stock lick for some time before drenching.

The sheep should be drenched with a mixture of arsenic and epsom salts.

The ingredients are:—

2 oz. arsenic (95 to 98 per cent. purity),
6 lb. epsom salts, to
5 gallons water.

To Prepare.—Bring 2½ to 3 gallons of water to the boil, then add the 2 oz. of arsenic and the 6 lb. epsom salts. Stir and bring to a brisk boil. Boil vigorously for about five minutes, and stir well. Then allow to simmer for half an hour longer, stirring occasionally. Add cold water to make up to the 5 gallons. This mixture will now be ready for immediate use.

Dose.—

For grown sheep, 2 fluid oz.;
For weaners, 8 to 15 months, 1½ fluid oz.;
From four to eight months, 1 fluid oz.

Lambs under three months old should have the dose reduced according to size and age of lamb. If the milk secretion is good, the lambs will not need drenching, but if eating grass freely they will pick up the worms and suffer more severely owing to their weaker constitution, therefore drench them if necessary. A flask can be procured suitable for administering the drench according to dose; otherwise a sauce bottle will be found suitable, but will require to have the dose measured properly. The sheep should be kept away from food and water for at least twelve hours before drenching (if not already starving) and about four hours after drenching (at least from water).

The sheep should be on all fours while being drenched, the operator holding the sheep between the knees with the left hand under the jaw and the right hand administering the drench with the flask. Should the sheep struggle or cough discontinue pouring the drench and wait till the sheep becomes normal before continuing. It is usually found most convenient to run a number of sheep into a narrow lane about 30 in. wide for drenching purposes.

By dissolving 4 oz. of bluestone and adding it to the arsenic and epsom salts mixture when making up to the 5 gallons a powerful drench is secured at a low cost which is suitable for the control of stomach worms and will also kill tape worms and at least some of the bent-head round worms in the large intestines.

The bluestone should be dissolved separately in an earthenware, glass, or wooden container.

The doses are as set out in the recommendations for dosing with the ordinary arsenic and epsom salts drench, but must be modified regarding lambs and growing sheep, and can be as follows:—Grown sheep 2 fluid oz., hoggets (2-tooth) 1½ fluid oz., and then reduced according to size and age of lamb to 1 oz. at six months, continuing the reduction to younger lambs, or give the arsenic and epsom salts.

Bluestone Drench for Stomach Worms.

As a change from the arsenical drench, the bluestone and mustard drench can be successfully used, say every third or fourth drench.

The ingredients are: —

1 lb. bluestone,
1 lb. fresh mustard,
10 gallons water.

To Prepare.—Suspend the bluestone in soft or rain water secured in a piece of hessian. Mix the mustard in a little water until thoroughly moistened, then dilute with larger quantity and mix with bluestone water, which is made up to the full quantity of 10 gallons.

When all the bluestone is dissolved it should be well stirred and administered in correct doses.

Grown sheep, 4 fluid oz.; weaners, twelve months old, 3 fluid oz.; lambs, four months old, 2 fluid oz. The bluestone water should not come in contact with metal. Wood or enamelware is suitable. Care must be exercised in administering this drench, as it is a bigger dose than the arsenical dose, and takes longer to swallow. The sheep are more apt to take it on their lungs, which is injurious, and may prove fatal. This drench is useful if administered after giving the sheep the same treatment as recommended for the arsenical drench.

Nodule Worms in Sheep.

This affection is caused by a worm known as *Oesphagostoma Columbianum*. The lesions caused by this parasite are in the form of nodules on the intestines from which it gets many local names. The life history of this parasite is that it enters the wall of the intestine where it remains from three weeks to at least four months, during which time it is surrounded by a cyst which causes the tumours or nodules. It then emerges from the nodule into the large intestine, where it matures and lays eggs. According to the Thirteenth and Fourteenth Reports of the Director of Veterinary Education, South Africa, they are known to live in the large intestine of sheep for twenty-one months, during which time they lay eggs in large numbers. One lamb artificially infected with 2,000 larvæ was reported to have voided 2,000,000 eggs in one day, and continued in irregular numbers up to the time of its death at four and a-half months, when it had voided over 31,000,000 eggs. From the time the egg is passed outwith the fæces to its encysting itself in the walls of the intestine there is some doubt, but it is known that in moist, warm places the eggs hatch out in a few days and are taken in by the sheep.

They pass through three moulting stages before maturity in the large intestine, from which they are difficult to dislodge with drenches. The embryos or young worms are first found in the wall of the intestines, the numbers present being the deciding factor against the health of the sheep. Diarrhœa and emaciation are the results of the presence of those worms when in large numbers, and the general condition of the flock is largely reduced by this parasite.

Still, it is surprising how the majority of sheep killed for mutton are found to be in good condition, although affected with the parasite.

Treatment.

Treatment consists of the elimination of the mature worms from the bowels by the use of such agents as—

(1) One part turpentine to sixteen parts of milk, the dose varying from 2 to 4 oz.

(2) One teaspoon turpentine to 1 oz. castor or raw linseed oil.

(3) One teaspoon Kerol to 1 oz. castor or raw linseed oil.

(4) Enema treatment—One and three-quarters to two pints of Acacia gum solution or lukewarm soap suds, wtih a worm-killing agent added, such as one spoonful turpentine or a dose of drenching mixture such as the arsenical or bluestone drench. The mixture can be dosed per rectum, and if repeated a week later will cause large numbers of the adult worms to be expelled.

(5) Two ounces arsenic, 6 lb. epsom salts, 4 oz. bluestone, 5 gallons water. To mix, bring 2½ to 3 gallons of water to the boil, then add the arsenic and epsom salts, and boil for forty minutes or until the arsenic is thoroughly dissolved. Dissolve the 4 oz. bluestone in one quart of water (glass, earthen, or enamel ware), and add to the arsenic and epsom salts when making up to the 5 gallons.

Dose.—

2 oz. for mature sheep,

1½ oz. for hoggets twelve to twenty-four months,

1 oz. for lambs six to twelve months.

This mixture was found to be most satisfactory for stomach worms as well as the nodule worm.

Prevention consists chiefly of change of pasture where possible. The sheep should not be allowed to drink from stagnant water, owing to the fact that they usually drink from the edges where the water is shallow and contaminated.

A suitable lick should be supplied which, according to results obtained from the South African experiments (*vide* Thirteenth and Fourteenth Reports) should contain two parts crushed dry tobacco leaf, two parts bone meal, one part kitchen salt, which, according to weight, would be 234 lb. bone meal, 52 lb. tobacco dust, 100 lb. salt. The mixture was slightly moistened when placed in the troughs.

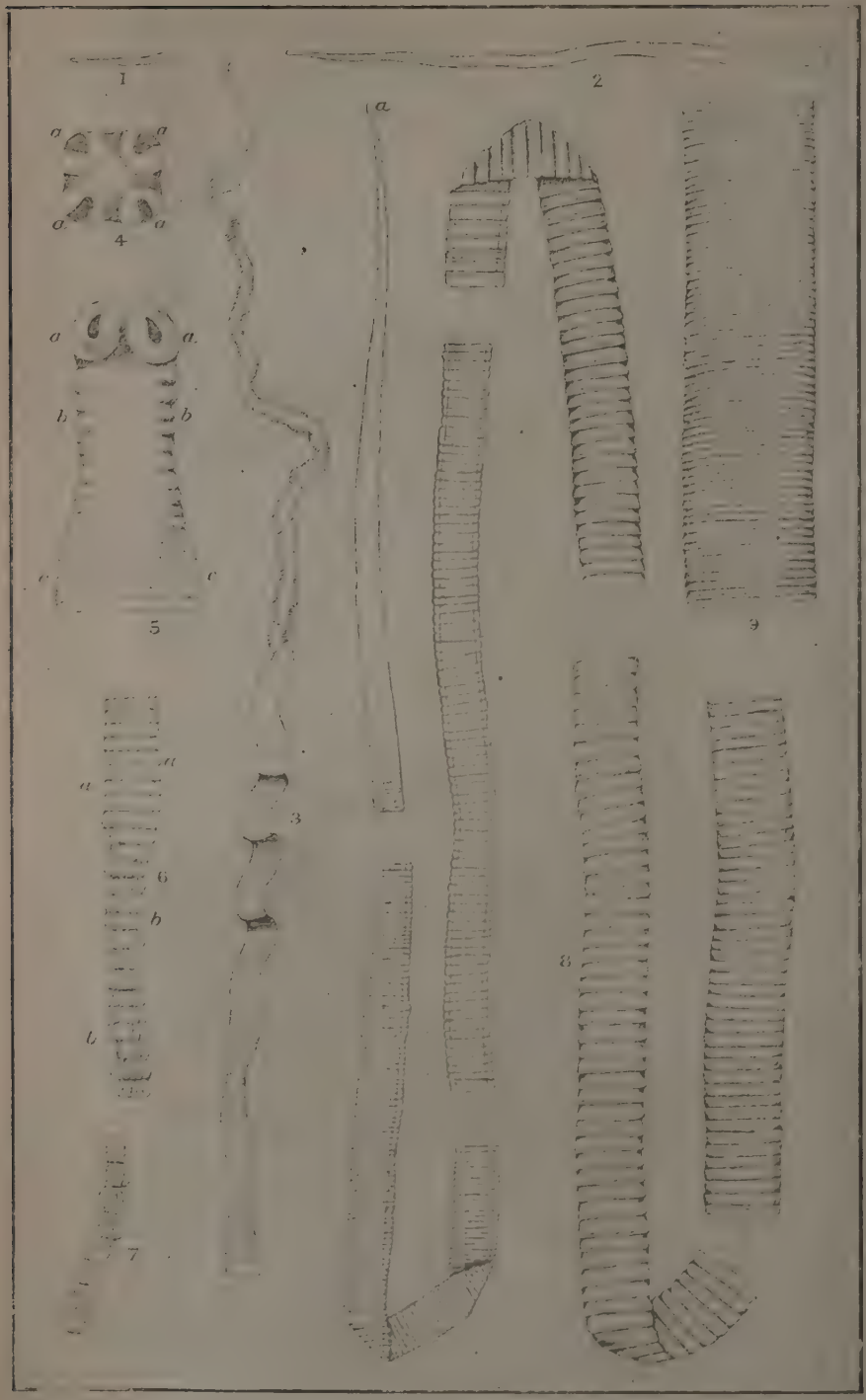

PLATE 164.—THE TAPEWORM (*Tænia expansa*).

Description of Plate 3.

Tape Worm (*Tænia expansa*).

Figures 1 and 2.—Young tape worm, natural size.

Figure 3.—Head end of tape worm drawn to show vermicular contractions when living.

Figure 4.—Head, top view. AA suckers or cups by which the worm attaches itself to the intestinal walls.

Figure 5.—Head, side view. AA suckers, BB folds in the back, CC the first segments.

Figure 6.—The large end of a young tape worm. AA segments which are not mature enough to drop off, BB segments ready to pass from the worm.

Figure 7.—Segments of proglottides found separate from the worm.

Figure 8.—An adult tape worm drawn in sections at regular intervals apart; a head.

Figure 9.—A segment of another worm which is not only slightly longer, but whose segments are shorter and broader.

The specimens shown in figure 8 could have assumed much the same shape when alive as figure 9.

Tape Worms.

Eight varieties are known to infest the bowels of sheep, and during the time they are harbouring them they will not fatten.

Once rid of them they are not likely to suffer another attack.

Symptoms.

When harbouring these worms the animals becomes unthrifty and hidebound. The wool is hard and harsh in quality. The animal appears stiff when moving, and generally hangs behind the flock when being driven. They produce emaciation, with paleness of the mucous membrane of the eyes, nose, mouth, &c. The functions of the digestive organs are impaired, the food being chewed irregularly, breath unpleasant, occasionally colic, tympany of abdomen, diarrhœa with mucous, in which is frequently found segments of the tape worms. If not attended severe infestation causes ultimate death from poverty and exhaustion.

Prevention.

Prevention consists in draining damp lands, stagnant water holes, &c., and by keeping uninfested sheep from known infested pastures.

The thorough cultivation of infested land is one of the most satisfactory means of destroying these parasites.

Treatment.

The regular drenching in the control of stomach and intestinal worms has an important influence in controlling tape worms.

Should these regular drenchings fail to create an improvement, a special drench can be given to those showing symptoms.

For lambs six months old—

Oil of turpentine, 1 dr.
Powdered arecanut, 25 gr.
Extract of male fern, 15 drops
Raw linseed oil, 1 oz.

Fast the lambs for eight to twelve hours before and for three hours after drenching. Repeat the dose for three weeks at intervals of seven days.

SCABBY MOUTH IN SHEEP *(Stomatitis).*

Stomatitis or Infectious Labial Dermatitis.

This affection is due to various causes, but is most commonly seen after wet weather when grasses are abundant and affected with fungi. Unless affected animals are treated in the early stages of development serious consequences may follow.

Treatment.

Dose for sheep—

3 oz. epsom salts,

1 teaspoon ground ginger,

½ pint water.

Dose for lambs—

1 oz. epsom salts,

½ teaspoon ground ginger,

3 oz. water.

Smear the affected parts with salad oil or grease if scabby, otherwise dress with either of the following:—

1.—

½ oz. chloride of potash,

2 oz. glycerine,

1 pint water.

Apply with swab.

2.—

1 tablespoon salt,

1 pint vinegar,

1 quart water, well mixed together, and swab.

3.—

1 lb. bluestone,

1½ gallons water.

Dip the muzzle into the mixture.

Blight.

There are three forms called blight—(1) Dietetic, caused by eating plants charged with irritating poisons, when a change of pasture is necessary, otherwise remove the cause. (2) Grass seeds. Remove the seeds, clean the eye, and wash with boracic water. (3) Real blight, pink eye. Make the following solution, and apply six drops daily:—10 grains sulphate of zinc, 20 grains boracic acid, 8 oz. boiled water.

The sheep should be isolated where good feed is plentiful and water handy.

Fine sugar is also a very useful agent used by being sprinkled into the eye.

Foot Rot or Foot Scald in Sheep.

This disease develops in most cases rather insidiously, and the animals retain their usual appetite. It begins with lameness, which is at first slight, and if not attended to, later becomes very intense. On examination, the coronet and lower part of the limb as high as the fetlock are found to be swollen. Upon a close examination an offensive discharge is discovered in between the claws.

Treatment.

The diseased sheep should be immediately separated and isolated from the healthy ones, and kept in a scrupulously clean and dry place. A foot bath should be constructed and filled with a solution containing 4 per cent. sulphate of copper. Through this the sheep are passed three times a week.

In cases where the feet are extensively diseased, the loose portions of horn should be removed. In mild cases where only a few sheep are affected, vaseline with 5 per cent. iodine can be applied daily to the affected parts.

Inflammation of the Udder (Garget).

If the feed is good at lambing time the flow of milk is also likely to be good, and if not taken away the udder becomes inflamed and swollen.

The best treatment is to give a purgative such as 2oz. epsom salts, 1 dr. ginger, in 4 oz. warm water.

Extract all milk possible, bathe the udder with hot water, inject a solution of carbonate of soda into the teats, and milk it out soon after. Dress the udder with embrocation. Repeat the treatment.

Hoven or Bloat.

This condition is set up when feed is plentiful and luscious, especially where clovers are abundant. If sheep are to be changed from a grass paddock into one likely to cause hoven, they should be allowed to fill as much as possible, then given a drink, and allowed on the luscious feed for a limited period, then taken off for two or three hours and put back to remain or repeat the short-period feeding for a few days before putting them on permanently.

Treatment.

When first development is noticed a dose consisting of one teaspoonful of bicarbonate of soda and an equal quantity of ground ginger in 4 oz. of warm water should give relief, otherwise the trocar direct into the rumen is the surest remedy. All extreme cases should be treated in this way.

Impaction.

Under dry conditions, when the grass is matured and hard or when sheep are being fed on scrub, impaction is likely to occur.

Treatment.

Two ounces castor and 2 oz. raw linseed oil and one teaspoon of aromatic spirits of ammonia or 2 oz. epsom salts in half a pint of warm water.

Prevention.

A good stock lick to be supplied during the time the sheep are on such hard feed.

Sheep Maggot Flies.

Parasites, either internal or external, render the sheep more prone to fly attack. Internal parasites, especially stomach and intestinal worms, are the worst offenders, as when they become troublesome they cause derangements of the digestive organs resulting in mild to severe scouring according to the severity of attack. This scouring will develop whether the sheep are on a scanty pasture or not, with the result that if flies are present the scouring sheep affords a suitable striking ground.

PLATE 165.

A FLY-STRUCK EWE.

PLATE 166.—JETTING RACE, BARATRIA STATION.
Note hand raised to pull cord in closing swing gate. Total length of race 50 ft., width 16 in., height to 3 ft. 6 in.

PLATE 167.—JETTING SHEEP AT BARATRIA STATION.
Note hand on lever to open sliding gate.

If the feed is green and plentiful the excreta of the sheep is likely to become soft and adhere to the wool. If a few flies are about after the first rain an increase can be expected, but by the time they become numerous, if the dags are dry, no serious attack can be expected, but should a shower of rain fall and these dags become damp a serious attack may occur. Should the sheep be crutched, shorn, dipped, or jetted beforehand much trouble is saved, and probably no complete estimate of the advantage derived from the operation, whichever it may be, is noticed. Should the sheep be in half wool or longer when the attack occurs the quickest way of giving protection is the most satisfactory, as once a sheep is struck other flies are attracted, probably resulting in a severe infestation in a few days.

Any mustering where clean sheep are brought into contact with those that are blown only encourages further trouble unless the maggots and flies are destroyed or the sheep protected.

Jetting or dipping, if properly done, will kill the maggots on the sheep as well as poison many of the flies that are attracted by the moisture in the wool. The two chief points to be considered are to see that the poisoned liquid penetrates to the skin and that it is of the desired strength. Jetting is performed by forcing the prepared liquid through a nozzle into the crutch of the sheep.

The area that should be jetted as a safeguard against the attack of the fly should be over a space extending from above the tail and carried down at each side of it to the crutch, which should take in all the stained portion. Length of wool or the presence of dags do not matter, provided the mixture is forced to the skin. The long wool will hold more poison, thus giving a greater amount of protection. Sheep that are struck should be crutched and hand dressed, or jetted without being crutched. When the sheep are returned to their pasture, if time permits, those showing distress can be given any further treatment that is necessary. If the wool is removed the usual force of jet would be too severe, and cause injury if not death. A hospital paddock should be set aside for all affected sheep; this for two reasons: firstly, to save travelling and hold them in a convenient paddock, and, secondly, once a sheep is struck it is more subject to further attack, and is best kept out of the healthy flock.

The Committee of Investigation under the Council for Scientific and Industrial Research who conducted the experiment at Dalmally, 1918 to 1921, concluded that jetting with a solution consisting of 7 lb. arsenic with an equal quantity of carbonate (washing) soda to 100 gallons of water gave 90 per cent. protection for three months. The weather at and after jetting is an important factor, but it is regarded that the quantity of arsenic in the wool of the breach is the ingredient giving protection. Many dip mixtures are on the market, those containing arsenic being the most effective in protecting sheep.

The pressure necessary varies according to the length of wool from 160 lb. per square inch for sheep carrying eight months' wool to 60 lb. per square inch for crutched or shorn sheep. Jetting in an ordinary race is not so satisfactory as where the sheep are in a raised race. The upward tendency when applying the jet is a decidedadvantage, besides which the surplus mixture which falls from the wool can be recovered. This, on analysis, loses very little strength. Where small numbers are to be treated a hand pressure pump will be sufficient, but in dealing with large numbers a power plant is the most suitable.

When investigating the fly trouble in the Central West the weight of evidence was in favour of jetting. Mr. Barton, Baratria Station, states that, provided the jetting mixture is correct and properly applied, he has every confidence in its being the best means in protecting large flocks of sheep. On Baratria Station there are three elevated races erected which are the cheapest, simplest, and most economically worked that I have seen in use, and quite as efficient as any other style for thorough application. It is 50 ft. in length and 3 ft. 6 in. above ground level at the highest point just ahead of where the sheep is jetted. It is fitted with two sliding and one swing gate. This swing gate forms part of the side of the race. When the sheep passes this swinging gate the sliding gate is pushed across the race to hold it while being jetted. (Plate 166.) When the sheep is jetted the jet operator opens the sliding gate with his left hand by means of a long lever, and at the same time opens the swing gate. The jetted sheep, seeing the opening in the race and also the jetted sheep in the yard, moves away and is followed by the next sheep, the sliding gate being pushed back to keep it in position while the swing gate is drawn back across the race by means of a rope by the man whose duty it is to keep the sheep up to the jetter. This swing gate (Plate 167) holds the next sheep back and at the same time gives the opening in the side of the race to the jetter to work the nozzle which should be a straight jet.

The race is 16 in. wide, inside measurement, and is floored with battens 3 in. by 1½ in., spaced ¾ in. apart. The uprights in use were 3 by 2 in. hardwood, as were also the sleepers to carry the crosspieces in the race. The ramp is 14 ft. in length, starting at the forcing yard at 6 ft., narrowing down to the race 16 in. wide. Bush timber for uprights would be suitable, as also for sleepers to carry the crosspieces in the race. These latter, as well as the crosspieces in the ramp, could also be split bush timber. While present, Mr. Barton jetted one hundred sheep in twenty-five minutes, having four men keeping the sheep up to him.

If jetted sheep are blown the poison in the wool controls the growth and spread of the maggot.

Dipping.

This is another means by which both maggots and flies can be controlled and the sheep protected for several weeks.

The strength of the mixture should be at the rate of 2 lb. arsenic to 2 lb. carbonate of soda per 100 gallons of water when the wool is up to four months' growth. When the wool is longer the strength can be reduced to 1½ lb. at nine months' growth, but the longer the sheep must stay immersed.

Crutching also is an advantage, and to a great extent assists in protecting the sheep, as 90 per cent. are likely to be struck about the crutch. In yarding and crutching only the sheep already struck more harm than good is likely to be done, as mustering clean sheep and bringing them in contact with those that are blown usually causes a further spread of the trouble.

In crutching there is no attempt to deal with the fly, and it often happens that a few weeks after crutching 20 per cent. of the flock will be suffering from a fresh attack. As the maggots develop they do not find sufficient covering in the crutched part, with the result that they spread to the long wool. Their presence in the body wool soon induces flies to that part, where further trouble is generated.

If crutching is practised midway between shearings good must result, especially where ewes are treated, as by the time shearing comes on there is a sufficient length of wool to be properly shorn, but if the wool is short it is often missed, with the result that many sheep are turned out prone to a fresh attack at no distant date.

Swelled Head in Rams.

Several reports from various parts of Australia indicate that this affection is widespread.

In Queensland a few cases showing similar symptoms were reported, but whether the complaint was of the same origin is not known. The cause of this complaint was unknown until recently, when Dr. L. B. Bull, Bacteriologist to the Adelaide Hospital, appeared to have solved the problem when investigating the disease.

He states that the disease is caused by the presence of a minute bacillus or germ which was found under the skin of the swollen tissues of the head.

Tetanus or Lockjaw.

This is caused by the presence of a germ picked up, usually from the soil.

Prevention is better than curative treatment, although the idea that the disease is always fatal is not correct, as many so affected recover without aid. All wounds at shearing or lamb marking should be treated with a good disinfectant.

All tools should be dipped in some good disinfectant before and during the time they are in use.

Shearing sheds and yards should be treated with a strong antiseptic solution.

Lamb marking in old yards should be avoided if possible, and lambs marked in temporary yards in order to allow them being placed on clean ground after marking.

Symptoms.

Grinding the teeth, stiffness, difficulty in swallowing, twitching of the muscles of the face, projected eyelid, followed in final stages by stiffening of jaws, quivering and general stiffening of the muscles, panting, rapid and short pulse beats.

Anti-tetanic serum injected under the skin at or just previous to shearing will safeguard valuable animals against the action of tetanus germs.

Should sheep die from this complaint they should be completely burned as soon as possible.

Pizzle Disease (Balanitis).

This trouble is usually found amongst merino wethers which while suffering from it are not likely to put on flesh. Cases are found which are quite local, caused by grass seeds and dirt, but the usual cases are those where irritation is caused by an accumulation of corruption blocking the opening.

In some districts this disease becomes very serious, and carries *bacillus necoisis*, and seems to be a common complaint amongst aged wethers in many districts.

In mild attacks cleaning the opening of the sheath and disinfecting same may be sufficient, but in the cases where an abscess has formed, all wool should be cleaned away and the sheath completely opened until the pizzle is exposed. Clean away all corruption and apply a strong salt solution, a 2 per cent. bluestone solution, or a proprietary disinfectant, many of which are on the market.

Cheesy Gland Disease (*Caceous lymphadenitis*).

This is a disease that affects the glands of sheep, and is caused by a special microbe or bacillus, Preisz-Nocard, to which the Council of Scientific and Industrial Research has been giving much attention during recent years. This disease does not impair the health of the sheep to any great extent, but from an economic point of view it is of great importance to our sheep breeders, as all carcasses showing diseased glands are rejected for export. The glands most frequently affected are those situated in the shoulders, flanks, and thighs. Infection occurs through wounds, and may be transferred in the process of shearing when glands are ruptured with the comb of the machine, after which the pus may adhere to the comb, the shearers' clothing, or drop on the shearing board or in the counting-out pen.

Whenever it is noticed that an abscess has been opened in shearing or that the machine has become contaminated by passing over an abscess already discharging, they should be cleaned and disinfected. Lamb marking should, as far as possible, be practised on grass land in temporary yards and dropped carefully, feet downwards, on the grass after being disinfected. Investigations up to the present time point to the process of shearing as introducing the greatest percentage of infection in Australia. This is important, and indicates that great care should be exercised in the grinding of combs, leaving the points as full as possible, when they would be less liable to puncture the skin, and also to the advantage likely to be gained by disinfecting the sheep as soon as possible after shearing, probably when leaving the counting-out pens. The shearing board and yards should be disinfected at least before and after shearing, and the lambs shorn first.

Investigations are still in progress.

Sheep Skins.

On many holdings sheep are killed for rations. In such cases they should be skinned carefully and the skin hung in the shade to dry.

When dry, they should be painted with a mixture to protect them from the attack of the weevil or moth the larvæ of which does considerable damage. Make a mixture by boiling 1 lb. arsenic and 1 lb. washing soda in 2 gallons of water, and paint the flesh side of the skin while the mixture is still warm; or boil 3 lb. sodium sulphate in 1 gallon of water for twenty minutes, and paint while lukewarm. If skins are properly removed and cured they will retain their value for a considerable length of time.

If you like this issue of the Journal, kindly bring it under the notice of a neighbour who is not already a subscriber. To the man on the land it is free. All that he is asked to do is to complete the Order Form on another page and send it to the Under Secretary, Department of Agriculture and Stock, together with a shilling postal note, or its value in postage stamps, to cover postage for twelve months.

PRODUCTION RECORDING.

List of cows and heifers officially tested by officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Book of The Jersey Cattle Society, The Australian Illawarra Shorthorn Society, and The Friesian Cattle Society, production charts for which were completed during the month of September, 1932 (273 days period unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
	JERSEY.	Lb.	Lb.	
	MATURE COWS (OVER 5 YEARS), STANDARD 350 LB.			
Bellefaire Twylish's Bellette	F. J. Cox, Imbil	8,000·45	467·61	Werribee Prince Twylish
Lady Crocus	J. Nicol Robinson	7,953·4	396·713	Retford Statesman
Lily of Calton	F. J. Cox, Imbil	6,392·3	374·345	Retford K.C.
Little Lettie of Burnleigh	W. Mallett, Nambour	6,652·6	353·428	Trinity Baron
	SENIOR, 4-YEAR OLD (BETWEEN 4½ AND 5 YEARS), STANDARD 330 LB.			
Marla of Armley Park	Hurst Brothers, Nerang	6,205·41	356·619	Avondale Golden Ferns Noble
	JUNIOR, 4 YEARS OLD (BETWEEN 4 AND 4½ YEARS) STANDARD 310 LB.			
Yimmin Bright Lass	R. A. Anderson, Yandina	5,564·25	324·603	Yimmin Starbright King
	SENIOR, 3 YEARS OLD (3½ TO 4 YEARS), STANDARD, 290 LB.			
Nightshade of Rosedale	Wakefield Bros., Upper Barron	5,663·2	341·659	Oxford Prince Palatine
Mabel of Brook Lodge	H. T. Mayers, Nambour	5,321·87	324·268	Waimate of Brooklodge
	JUNIOR, 3 YEARS OLD (BETWEEN 3 AND 3½ YEARS), STANDARD, 270 LB.			
Newhills Princess	J. Nicol Robinson, Maleny	6,048·45	399·885	Prince Harry of Newhills
Carnation Queenie (266 days)	Spresser and Sons, Brassall	4,469·5	281·85	Carnation Renown
Winsome Lassie 2nd of Peachester	D. Mcdonald, Peachester	4,728·95	275·018	Trinity Roadside
	SENIOR, 2 YEARS OLD (BETWEEN 2½ AND 3 YEARS), STANDARD 250 LB.			
Trecarne Rosebud	T. A. Petherick, Lockyer	5,229·95	273·019	Trecarne Sultan
	JUNIOR, 2 YEARS OLD (UNDER 2½ YEARS), STANDARD 230 LB.			
Scycombe Gaiety	A. E. Trigger, Didcot	4,345	306·142	Upwell Prime Minister
Maybelle of Avonmore	R. C. Murdock, Cooroy	4,578·1	258·919	Prince Palatine of Cooroibah
Newhills Pearl (265 days)	J. Nicol Robinson, Maleny	4,049·91	256·027	Newhills Mascot
Carmilla of Peachester	D. Macdonald, Peachester	4,768·4	253·314	Trinity Roadside
Carnation of Cooroibah	Hurst Brothers, Nerang	4,489·25	239·041	Laddie of Cooroibah

AUSTRALIAN ILLAWARRA SHORTHORNS.

Mature (over 5 Years), Standard 350 Lb.

Westbrook Lark 3rd	W. F. Kajewski, Glencoe	10,332·93	450·232	Sheik of Upton
Gem 4th of Oakvilla	H. Marquardt, Wondai	9,364·06	397·558	Victory of Greyleigh
Daisy 8th of Oakvilla	H. Marquardt, Wondai	9,956·32	390·238	Victory of Greyleigh

Junior, 3 Years Old (between 3 and 3½ Years), Standard 270 Lb.

College Gold	Queensland Agricultural High School and College, Gatton	6,909·94	282·673	Fussy's Kitchener of Hillview
Phyllis of Murray's Bridge	Hemmings Bros., Murray's Bridge	7,116·25	281·934	Valiant of Greyleigh

Senior, 2 Years Old (between 2½ and 3 Years), Standard 250 Lb.

Lilac 2nd of Rosenthal (365 days)	S. Mitchell, Warwick	9,386	382·302	Sunrise 3rd
Bella 19th of Fairlie	C. B. Mitchell, Warwick	8,420	334·265	Dividend of Rosenthal
Glenroy Pearl	W. F. Kajewski, Glencoe	6,917·03	301·819	Brilliant 2nd of Oakvale
College Ida	Queensland Agricultural High School and College, Gatton	6,866·95	289·76	College Heir
Crimson of Glendalough	Hickey and Sons, Wilston	7,326·89	262·263	Don of Springdale

Junior, 2 Years Old (under 2½ Years), Standard 230 Lb.

The Glen Orange	A. C. Stewart, Coondoo	6,896·85	298·188	Lorna's General of Arley
Pensive of Glen Cairn	H. M. Graham, Goomeri	6,551·06	280·417	Nelson of Darbalara
College Vita	Queensland Agricultural High School and College, Gatton	6,662·67	240·766	Fussy's Kitchener of Hillview
Sunbeam of Trevor Hill	G. Gwynne, Umbiram	6,635·8	239·977	Illawarra II. of Mayfield
Fairy 6th of Fairlie	C. B. Mitchell, Warwick	5,652	233·902	Auditor
Doris of Glen Cairn	H. M. Graham, Goomeri	6,282·18	230·945	General of Croydon

FRIESIAN.

Senior, 2 Years Old (between 2½ and 3 Years), Standard 250 Lb.

Oaklands Beauty Rock	W. Richters, Tingoora	6,892·01	272·907	Pied Rock

STOCK FEEDING.

By E. H. GURNEY, Senior Analyst.*

OWING to the low price now obtaining for all products of animal husbandry it is imperative for the stock feeder to consider what are the best means at his disposal of obtaining nutritious food for his stock, at a minimum cost.

Our climate is such that at certain periods of the year there are produced very large supplies of natural grasses, which in the young stage of growth are nutritious and may be considered as the best and cheapest single stock food available, but owing to the climatic conditions, these grasses very quickly reach an advanced stage of maturity, at which stage they can only be considered as roughage containing very little nutriment. Therefore, when grass feeding is largely depended upon, in times of winter or drought grass scarcity it is necessary for the stock feeder to consider what under his conditions are the most economical means to be taken to obtain supplies of nutritious feed stuffs.

If such additional feed stuffs are not given the productive ability of the animal, obtained in time of plentiful grass supply, is arrested, and the maintaining of any animal at less than its true productive power cannot be considered economical at any time, but more particularly is this the case when low prices obtain for animal products.

The aim then is to obtain feed material at a cost which will be covered by the returns from the animals, with which returns the advantages gained by not allowing the general health and condition of the stock to run down must be taken into consideration.

The cheapest foodstuffs are those grown upon the farm, but what particular foodstuff should be grown, and in what condition fed must be left for decision by the individual stock feeder. But in districts where dairy farming is conducted the great losses which occur through winter grass scarcity could be to a large extent reduced if one of the methods or combinations of methods for feed production mentioned below, was followed, viz.:—

The cultivation of lucerne to be fed green or as hay.

Cultivation of such crops as maize, sorghum, cow-cane, &c., to be fed green or as silage.

Subdivision and improvement of pastures and fertilizing, excess pasture growth to be stored as hay or silage.

Objects of Feeding.

Food is required by the animal in order that the digested portion may be used as material for building up the different organs of the body, and for the replacement of such as they become worn out.

Food is also required as a source of heat and energy. These are supplied by the oxidation of some of the food ingredients, and the heat and the energy produced by this process of slow combustion are used to maintain the body temperature, and to perform work such as locomotion, digestion, blood circulation, &c.

Constituents of Foods and their Functions.

The constituents of foods are classified under the following groups:—Moisture, Protein, Fat, Carbohydrate, Fibre, Mineral Matter, and Vitamins.

Moisture.

All foods contain moisture in varying amounts, but as the animal body consists of water to the extent of about two-thirds of its weight, water must form a separate portion of the food.

Proteins.

The nitrogenous matter in foodstuffs is mostly protein. The proteins are complex substances which always contain carbon, hydrogen, oxygen, and nitrogen, and usually contain sulphur and frequently phosphorus, the nitrogen content being approximately 16 per cent.

The proteins are formed by the combining together of a number of simpler bodies called amino-acids.

* In a radio lecture from 4QG.

During digestion the insoluble proteins are converted into these soluble amino-acids, which are then passed through the walls of the stomach and intestines into the circulating blood, which carries these amino-acids to different parts of the body, where they are recombined to form the particular protein required. About twenty amino-acids are known.

Plants, from material obtained from soil and air, can build up these amino-acids, but for live stock it would appear advantageous to be supplied with food containing all the different amino-acids required for building up the protein of their body.

The proteins of foodstuffs vary very much in so far as they may be composed of different amino-acids, and therefore by feeding live stock with different foodstuffs there is less chance of any required amino-acid being absent.

Proteins are utilised by animals for the formation of flesh, muscle, and blood, and hence for quick growth to take place an ample supply of protein must be present in the feed.

This fact is well illustrated by the analyses of the milk of different animals. Thus, mare's milk contains 1.8 per cent. protein, and the colt doubles its weight in 60 days; cow's milk contains 3.5 per cent. protein, and the calf doubles its weight in 47 days; whilst sow's milk contains 7.2 per cent. protein, but the young pig takes only 10 days to double its weight. Thus it is seen that quickness of growth is provided for by increased protein content in the mother's milk.

From this it will be seen why young stock should always be fed with what is termed a "narrow" ration, that is a ration in which the protein content is relatively high compared with the amount of other nutrients present.

If protein in an excess amount is fed it is broken down into amino-acids which are carried by the blood to the liver, where they are deprived of their nitrogen and converted into carbohydrates and fats, and the separated nitrogen ultimately converted into uric acid and urea, these substances being ejected by the kidney.

Protein being the most expensive nutrient to buy, it should be the aim of the feeder to supply a sufficiency of protein for the particular purpose desired, but any excess is wasteful, both from the monetary point of view, and the unnecessary energy required from the abovementioned organs. In fact, a very excessive amount of protein may cause disease.

Carbohydrates.

These substances contain carbon, hydrogen, and oxygen, the two latter elements in the same relative proportions as found in water. Such substances as sugars, starch, and cellulose are carbohydrates. The fibre of food stuffs is chiefly cellulose. During digestion the more complex sugar and starches are broken down into simpler sugars, which are absorbed into the blood through the walls of the intestines. These simpler sugars combine with the oxygen of the blood, being converted into Carbon Dioxide and water, this process of oxidisation yields heat and energy required for functions of the body. Excess carbohydrate is stored in the body as fat or glycogen (animal starch) in the muscles and liver, such storage being drawn upon if required.

It has already been stated that proteins can be used by the animal to replace carbohydrates, but carbohydrates cannot replace protein.

Fats and Oils.

These substances are compounds of carbon, hydrogen, and oxygen, being known as fats when in the solid form, and oils when in the liquid form at ordinary temperatures. They contain very much less oxygen than carbohydrates, as they contain about 11 per cent., whereas carbohydrates may contain from 49 to 53 per cent. For this reason the fats are capable of being oxidised to a greater extent than the carbohydrates and so have a higher value for production of animal heat and energy than the carbohydrates.

Mineral Matter.

It has long been known that mineral matter is required to build up the skeleton of the animal body, but from more recent research it has been shown that it is also necessary for the fluids of the body to contain a certain amount of mineral matter in order to obtain correct bodily functions. The mineral matter of foodstuffs influences the digestion, growth, health, and productive power of animals.

Though it is known that such minerals as calcium, phosphorus, magnesium, iron, and others are required by the animals, not much is known in connection with the relative proportion in which the minerals should exist to be most beneficial. Referring again to the milk of different animals, upon analysis it is found that the mineral matter of these milks contain high percentages of phosphoric acid and lime, and of particular interest is the fact that the percentages of these two ingredients is practically the same.

VITAMINS.

It has been demonstrated that a food containing all the nutrients previously mentioned in correct proportions and with suitable mineral matter, will not be able to promote growth and reproduction if certain accessory food substances are absent. Such substances are called "vitamins," and at least five of these substances are known, and they are distinguished by the first letters of the alphabet.

Vitamin A (or Fat Soluble A).

This vitamin is synthesised (built up) by plants, and is found in green foods such as lucerne, green grass, and in some seeds such as yellow maize, millet. This vitamin is not present in white corn, white leaves of plants, or in most root crops, though carrots contain it in considerable quantities.

Other sources of this vitamin are cod liver oil, butter fat, egg yolk, and fat.

Animals cannot synthesise this substance in their bodies, but must obtain it already built up in their food; but they have the ability to store it in their fat.

As this vitamin is necessary for growth, young stock must be well supplied with it, and if lacking in the food an adult animal is more liable to be affected with disease.

Vitamin B (it would appear that this is composed of two vitamins).

This is a disease preventing factor, and it induces growth. It is found in the germ and bran of all grains, in yeast, and in most foodstuffs.

Vitamin C.

Found in oranges, lemons, fresh green leaves, and fruits. It prevents the occurrence of scurvy.

Vitamin D.

This vitamin occurs with vitamin A in cod liver oil, and it occurs in a few other animal fats. This vitamin has the power to cure and prevent the bone disease called rickets.

A deficiency of lime and phosphoric acid in the feed will cause rickets, but even with a sufficiency of these minerals in the diet in the absence of Vitamin D or certain light rays these minerals will not be deposited, or are deposited in insufficient amounts on the growing bone. Certain rays of the sunlight called ultra violet rays, which rays may also be produced by a quartz mercury vapour lamp, have the power of acting upon the animal body and in some way changing some body substance into Vitamin D.

Vitamin E.

Appears to be associated with the reproductive organs, and if deficiency occurs the breeding powers are lessened.

It is contained in the green leaves of plants, and in germs of seeds such as wheat germ, and materials of this nature should be included in the diet of breeding stock.

From what has been stated it would appear that stock having green grass or green fodder in sufficient amounts will not be liable to have trouble through vitamin deficiency.

But where stock are fed on rations without green stuff, feeds known to contain vitamins should be included in the rations. Cod liver oil has improved the growth of calves when they are reared on milk substitutes.

Answers to Correspondents.

Cement Covering for Iron Roofs and Walls.

INQUIRER (Kingaroy)—

Mix thoroughly enough cement with fresh skim milk to bring it to the consistency of ordinary oil paint and apply with a whitewash brush.

This wash dries quickly, and will not be affected by rain after an interval of fifteen minutes has elapsed from the time of its application.

This treatment reduces the temperature within the building treated, improves its appearance, and increases the life of the iron. Colour may be added to the wash if desired.

General Notes.

Staff Changes and Appointments.

Mr. N. C. Copeman, Inspector of Stock, Kingaroy, has been appointed also an Inspector under the Brands Acts.

Messrs. W. H. Hitchins (Nambour), M. Thom (Palmwoods), W. J. Suarea (Beerburrum), P. Hicks (Dagun), W. Lazenby (Amamoor), H. C. Grigg (Cleveland), and E. E. McNall (Woombye), Loaders for the Committee of Direction of Fruit Marketing, have been appointed also Honorary Inspectors under the Diseases in Plants Acts.

Mr. C. C. Barth, Inspector of Stock, Gayndah, has been appointed District Inspector of Stock, Longreach.

Mr. H. K. Lowcock, Temporary Assistant Pathologist, Department of Agriculture and Stock, has been appointed Assistant Pathologist, Department of Agriculture and Stock.

Messrs. H. Lingard and G. W. Gaynor, of Palmwoods, have been appointed Honorary Rangers under the Animals and Birds Acts.

Constable J. F. Fallon, Kumbia, has been appointed also an Inspector under the Slaughtering Act.

Mr. C. N. Morgan, Agent under the Banana Industry Protection Act, Cooroy, has been appointed an Inspector under the Diseases in Plants Acts, The Summit, via Stanthorpe.

Council of Agriculture.

A Regulation has been issued under the Primary Producers' Organisation and Marketing Acts, which will empower the Minister for Agriculture and Stock, upon the recommendation of the Executive Committee of the Council of Agriculture, to appoint a member to fill a vacancy which may occur on the Executive Committee. No procedure is provided at present in the Regulations in connection with the filling of vacancies on the Executive in between meetings of the Council of Agriculture, and the new Regulation will accordingly make such provision.

Plain Turkeys Protected in the North.

An Order in Council has been issued under the Animals and Birds Acts, which provides that the Bustard or Plain Turkey shall be protected throughout the whole year in the Shire of Eacham. At present, the period of protection in the North is from 1st November to the 31st May. The Plain Turkey is a big asset on the Atherton Tableland, and lives practically on grubs and insects. These pests do a considerable amount of harm in the district, and it is considered that the period of partial protection is not sufficient to safeguard this valuable bird.

Pseudo Poultry Plague.

Advice has been received by the Department of Agriculture and Stock of a fresh outbreak of Pseudo Poultry Pleague (or Newcastle Disease of Poultry) in Victoria. About two years ago, this disease, which had not previously been known to exist in Australia, was found amongst poultry in Victoria, and action was taken by the Queensland Department to safeguard the poultry industry of this State by issuing a Regulation which provided that the owner of poultry from another State was required to deliver to the Inspector at the place of introduction a declaration that the birds were free from disease and had not been in contact with diseased poultry for the preceding three months; a certificate from a Poultry Inspector whence the birds had come to the effect that he had examined such poultry; and a certificate from the Chief Inspector of Stock or Chief Veterinary Surgeon in the State from which the poultry came to the effect that there had been no outbreak of pseudo poultry plague in that State during the preceding twelve months, and that such birds were the product of the State or had been in the State for the last twelve months. The person introducing poultry had also to deliver a permit to import, issued by the Poultry Expert of the Department of Agriculture and Stock, Brisbane.

In July, 1931, the Southern States were declared free of the disease, and the restrictions against the introduction of poultry were lifted, the Regulation which had been in force prior to the outbreak being reverted to. However, following upon this new outbreak of pseudo poultry plague, similar precautions are again being taken, and a Regulation has been issued recently embodying the same principles as those which were enforced following on the notification of the first outbreak of this disease.

Queensland Cane Growers' Council.

Executive approval was given to-day to an amendment of the Queensland Cane Growers' Council Regulations, which will provide that, in future, cheques drawn on the Defence Fund Accounts of the Council shall be signed by the Chairman, Secretary, and one other member of the Council. Previously, it was necessary to obtain the signatures of two other members of the Council in addition to those of the Chairman and Secretary.

Sanctuary at Koumala.

"Tedlands," Koumala, the property of Mr. C. Heron, has been declared a sanctuary under the Animals and Birds Acts, and it will be an offence for any person to take or kill any animal or bird on this property. Mr. Heron has been appointed an Honorary Ranger for this sanctuary.

Rural Topics.

Biblical Farming.

Concerning the farming of the Jews, we find there are many incidental remarks in the books of the Old Testament. On the conquest of Canaan, it appears that the different tribes had their territory assigned them by lot; that it was equally divided among the heads of families, and by them and their posterity held by absolute right and impartial succession. Thus every family had originally the same extent of territory; but, as it became customary afterwards to borrow money on its security, and as some families became wealthy and were obliged to sell, and others extinct by death without heirs, landed estates soon varied in point of extent.

In the time of Nehemiah, a famine occurred, on which account many had "mortgaged their lands, their vineyards, and houses, that they might buy corn for their sons and daughters, and to enable them to pay the king's tribute." (Nehem. v. 1.) Some were unable to redeem their lands otherwise than by selling their children as slaves, and others "bringing the sons and daughters of God into bondage."

Boaz came into some estates by inheritance. Large estates, however, were not approved of. Jewish proverbs 5 curse on those "that join house to house, that lay field to field, till there is no place, that they may be placed alone in the midst."

While some portions of land near the towns were enclosed, the greater part was in common, or in alternate proprietorship and occupation, as in our common fields. This appears both from the laws and regulations laid down by Moses as to herds and flocks; and from the story of Ruth, who, to procure sustenance for herself and her widowed mother-in-law Naomi, "came and gleaned in the field after the reapers, and her hap was to light on a part of the field (that is, the common field) belonging unto Boaz."

The crown-lands in King David's time were managed by seven officers; one was over the storehouses, one over the work of the field and tillage of the ground, one over the vineyards and wine-cellars, one over the olive and oil-stores and sycamore plantations, one over the herds, one over the camels and asses, and one over the flocks.

King Uzziah "built towers in the desert, and digged many wells; for he had much cattle both in the low country and in the plains; husbandmen also and vine-dressers in the mountains, and in Carmel, for he loved husbandry."

Even private individuals cultivated to a great extent, and attended to the practical part of the business themselves.

What Elijah Found.

Elijah found Elisha in the field, with twelve yoke of oxen before him, and himself with the twelfth. Job had 500 yoke of oxen, and 500 she asses, 7,000 sheep, and 3,000 camels. Both asses and oxen were used in ploughing; for Moses forbade the Jews to yoke an ass with an ox, their step or progress being different, and, of course, their labours unequal.

Among the operations of agriculture are mentioned watering by machinery, ploughing, digging, reaping, threshing, &c. "Doth the ploughman plought all day to sow? doth he open and break the clods of his ground? When he hath made plain the face thereof, doth he not cast abroad the fitches, and scatter the cummin, and cast in the principal wheat, and the appointed barley, and the rye, in their place?" The plough was probably a clumsy instrument, requiring the most vigilant attention from the ploughman; for Luke (ch. ix. 62) uses the figure of a man at the plough looking back, as one of utter worthlessness.

Covered threshing-floors were in use; and, as appears from the case of Boaz and Ruth, it was no uncommon thing to sleep in them during the harvest.

Corn was threshed in different ways. "The fitches," says Isaiah, "are not threshed with a threshing instrument, neither is a cart wheel turned about upon the cummin; but the fitches are beaten out with a staff, and the cummin with a rod (flail). Bread corn is bruised, because he will not ever be threshing it, nor break it with the wheel of his cart, nor bruise it with his horsemen." The bread corn here mentioned was probably the fare of the Romans (maize), which was commonly separated by hand-mills, or hand picking, or beating, as is still the case in Italy and other countries where this corn is grown.

Corn was "winnowed with the shovel and with the fan." Sieves were also in use, for Amos says, "I will sift the house of Israel, as corn is sifted in a sieve." Isaiah mentions the "digging of hills with the mattock"; to which implement the original pick would gradually arrive, first, by having the head put on at right angles, and pointed; next, by having it flattened, sharpened, and shod with iron.—"Live Stock Journal" (England).

Relative Food Value of Grain.

Experiments carried out at Hawkesbury Agricultural College in 1929 showed that even at 5s. 6d. per bushel the feeding of wheat to pigs was profitable. American experience in feeding wheat to lambs is that they made the same gains as those fed on maize, and only required 2 per cent. more grain and hay for each 100 lb. gain. Wheat is slightly better than barley for lambs, and less of it is required for 100 lb. gain in live weight. English experiments with lambs confirm American results. In America it has been shown that good quality wheat is worth as much as maize for feeding pigs. In Ireland pigs fed on wheat gave much better results than those fed on bran and pollard.

Wheat is a suitable feed for calves, fattening cattle, and dairy cows. For dairy cows in Denmark ground wheat was fully equal to mixed barley and oats. Provided the price is low wheat can also be fed with economy to horses.

Grass Our Most Valuable Crop.

In the final analysis, pointed out the Agrostologist of the New South Wales Department of Agriculture in a recent address to farmers, grass was after all our most important crop. The Commonwealth statistics for the year 1929-30 showed that whereas the value of production from agriculture was £77,000,000 sterling, the value of that of the pastoral industry was £84,500,000. The production from dairying was approximately £49,500,000, and the pastures must be credited with at least 75 per cent. of that amount.

Not only was pasture our greatest wealth-producing crop—it was at last being realised that its character and money-making ability were particularly amenable to control by scientific management. Sheep producing high quality wool, milking cows in high production, ewes rearing export lambs, animals being fattened for market, and particularly those bred for the production of early maturing beef, required feed of a highly nutritious nature, and the aim of the producer should be to supply the animals with the best of pastures as to quality and, at the same time, to carry the maximum number of stock on the holding. For maximum production, animals must have access to pastures which contained palatable and persistent types of pasture species most suited to the particular locality, and the areas must be efficiently managed and treated with suitable fertilisers to make up for the depletion of soil fertility which was going on continuously wherever animals were grazed.

The use of the best strains of pasture plants would result in greater value being obtained from plant food applied in the form of fertilisers, because the good strains of grasses and clovers, like good quality stock, would make better use of the food supplied than would the inferior ones.

Care should be taken not to overstock; stock would always pick out the most palatable and nutritious plants in a pasture first, and, if overgrazing occurred, the good grasses and clovers would be weakened and ultimately disappear from the sward.

The Defective Cream Can Reduces Profits.

Dairy farmers should see that their milk and cream cans are in a condition fit to contain these products. It is not sufficiently recognised that old rusty, broken or dented cans may be responsible for a large percentage of the objectionable taints that occur in cream and milk.

A rusty surface on the inside of a can is one of the chief troubles, but one which in many cases can be very easily remedied by re-tinning. When cream or milk comes in contact with rust patches, it is very likely to develop a metallic or a tallowy flavour, both of which are very objectionable taints for the butter-maker. If the rust is allowed to remain for any length of time, the surface will become badly pitted, and traces of milk and cream will lodge in the uneven face, with the result that harmful bacteria will rapidly develop and the fresh cream will be immediately infected and more than likely badly contaminated before it can be treated at the factory.

Cans which are badly dented, especially round the shoulders, it is often almost impossible to clean thoroughly without a great amount of trouble, and they should, therefore, be attended to immediately they are damaged. Broken necks and lids are objectionable, as they allow stale cream and milk to collect and contaminate the fresh cream. All loose bands, &c., should be thoroughly soldered up to prevent dirt, &c., collecting under them, since, although the milk or cream may not come in direct contact with this part of the can, objectionable bacteria will develop and may often contaminate the contents indirectly.

Although some jobs are best sent to a tradesman, a soldering outfit is a handy adjunct on the dairy farm, as there are many repairs that the farmer can do quite effectively for himself.

It is very false economy for the farmer to use for storing or carting of milk and cream a can exhibiting any of the defects mentioned.

The Home and the Garden.

OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staff of the Queensland Baby Clinics, dealing with the welfare and care of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable cases of infant mortality.

TOMMY REFUSES HIS DINNER.

TOMMY has always had a good appetite for his meals. His refusal comes as a surprise, nothing of this sort has ever happened before. What is his mother to do about it? If she is a wise woman she will not make a fuss about it, nor even give him a dose of castor oil, but will just do a bit of quiet thinking. Unfortunately there are many women who in such an emergency will do the worst thing possible. The unwise mother may coax or bully Tommy into eating what he had at first refused. This will do Tommy no good, and may make him a very sick boy.

Perhaps Tommy is not well. Have a good look at him. Is he feverish? If you have a thermometer, there is no harm in using it now. Does he look his usual self? Or is he stupid and heavy or excitable and irritable Has he a cough or a running from the nose or ear or a pain anywhere? Does he want to rest and lie down unlike his usual self? If he shows none of these symptoms, reflect that he may have had some food since his last meal without your knowing of it. Fruit and lollies, cakes and ice-cream, all these are possibilities. If you are satisfied that this is not so, reflect that you may have been over-feeding the boy. His want of appetite may be just Nature's attempt to save him from sickness. In any such case leave him alone. By next meal time the boy may be different.

Negativism.

Sometimes we have to deal with a much more serious situation. The mother is worried because Tommy is always refusing his meals. It has become a habit and she thinks he is getting thinner. How can we explain this? There is something wrong in the relation of Tommy to his mother. In nearly every instance we find this wrong thing first in the mother and not in Tommy himself. There are some women who take as naturally to the habit of scolding as ducks take to water. The natural reaction to scolding is to take as little notice of it as possible, to treat it like a thunderstorm, which may be unpleasant for a time, but will not last for ever. If this is not sufficient, the child develops a passive resistance, a mute obstinancy, a state of mind which scientific men call negativism. He can be forced to do some things, but he has discovered that he can't be forced to eat, and he won't.

Parental Errors.

This is not the most common cause. More often the mother's anxiety has led her to try coaxing and persuading. She has tried to tempt Tommy to eat by giving him whatever she thinks he will like, and then adding promises and bribes, which have failed to succeed. Tommy finds himself the centre of attention at every mealtime. He realises, perhaps unconsciously, that by refusing to eat he lives in the limelight, and he relishes this, until it becomes a morbid habit. Perhaps when no one is looking he will eat anything that comes handy, but this is not always so. He may really lose condition and the situation may become serious. The only thing the mother can do then is to alter her tactics. If he refuses a meal that is not really distasteful, smile and say "very well dear" and put it away until next mealtime arrives; giving him no food between meals. Probably by next mealtime he is really hungry, and if no notice is taken, will eat what is set before him. Few children will refuse more than two meals. If he is one of these few, his mother must put him in someone else's charge. We have known such cases in which a short stay in a private hospital has wrought a speedy and complete cure. The cure will last, unless the mother resumes her former unwise management.

If Tommy's refusal applies not to all foods, but to certain articles of diet only, two explanations may be suggested. Possibly, especially if an only child, he has been influenced by the fancies freely expressed or silently observed by him in older people, or a well-meant effort has been made to induce him, by the methods already described, to eat foods which were considered especially good for him, for instance, milk foods or green vegetables.

If the mother understood Tommy better and understood herself better, these difficulties would not occur.

SUNFLOWER SEED PRODUCTION.

The Minister for Agriculture and Stock (Mr. F. W. Bulcock) stated in the course of an interview recently with the members of the Canary Seed Board that he had discussed the possibilities of producing sunflower seed for commercial purposes.

The immediate Australian demand for the seed of the sunflower (*Helianthus annuus*) does not exceed several hundred tons yearly, but there are prospects that the market within the Commonwealth for this seed might be further developed. The variety of sunflower seed known here as Manchurian or Mammoth Russian is most suited for Australian requirements, and the planting of other varieties is not recommended.

Seed of the Manchurian variety is obtainable from the secretary of the Canary Seed Board, Box 185C, Brisbane. It is understood that the price of the seed is sixpence per pound.

The sunflower grows satisfactorily on similar soil types, and under the conditions of climate and methods of cultivation as are suitable for the production of maize. The sunflower is usually grown for seed but, in both the United States of America and Canada, the plant is used for silage purposes with comparatively satisfactory results, but it is not regarded quite the equal of corn in ensilage making.

When grown for seed production the planting should be in drills 36 in. apart, and the distance between the seeds in the drills should not be less than 15 in. From 7 to 8 lb. of seed is required to sow an acre of land. The seed may be sown satisfactorily with an ordinary grain drill, some of the seed tubes being plugged to suit the case. The sunflower is a summer crop, and may be planted during October.

In several of the countries where the growing of sunflowers is engaged upon the yield under average conditions ranges from 1,000 to 1,200 lb. per acre, while returns up to 1,700 lb. per acre have been recorded.

The market value of seed of good quality in Australia is seldom less than £18 per ton, and higher price levels are not unusual. To farmers with suitable land available for the growing of the sunflower a trial plot up to 3 acres in extent might be considered worth while.

In the meantime investigations are being made as to the prospects of sales of sunflower seed on the oversea markets, but these and other matters will be more fully enquired into in the event of the initial effort in production being sufficiently encouraging.

Orchard Notes for December.

THE COASTAL DISTRICTS.

THE planting of pineapples and bananas may be continued, taking care that the ground is properly prepared and suckers carefully selected, as advised previously in these Notes. Keep the plantations well worked and free from weeds of all kinds, especially if the season is dry. New plantations require constant attention, in order to give young plants every chance to get a good start; if checked when young they take a long time to pull up and the fruiting period is considerably retarded. Small areas well worked are more profitable than large areas indifferently looked after, as the fruit they produce is of very much better quality. This is a very important matter in the case of both of these fruits, as with the great increase in the area under crop there is not likely to be a profitable market for inferior fruit. Canners only want first-class pines of a size that will fill a can, and cannot utilise small or inferior fruit, except in very limited quantities, and even then at a very low price. Small, badly filled bananas are always hard to quit, and with a well-supplied market they become unsaleable. Pineapple growers, especially those who have a quantity of the Ripley Queen variety, are warned that the sending of very immature fruit to the Southern markets is most unwise, as there is no surer way of spoiling the market for the main crop. Immature pineapples are not fit for human consumption, and should be condemned by the health authorities of the States to which they are sent.

Citrus orchards require constant attention; the land must be kept well worked and all weed growth destroyed. Spraying or cyaniding for scale insects should be carried out where necessary. Spraying with fungicides should be done where the trees show the need of it. A close lookout must be kept for the first indications of "maori," and as soon as it is discovered the trees should either be dusted with dry sulphur or sprayed with the lime sulphur, potassium, or sodium sulphide washes. Borer should be looked for and destroyed whenever seen.

Early grapes will be ready for cutting. Handle carefully, and get them on to the market in the best possible condition. A bunch with the bloom on and every berry perfect will always look and sell well, even on a full market, when crushed and ill-packed lines are hard to quit.

Peaches, plums, papaws, and melons will be in season during the month. See that they are properly handled. Look out for fruit fly in all early ripening stone fruit, and see that none is left to lie under the trees to rot and thus breed a big crop of flies to destroy the mango crop when it ripens.

Keep leaf-eating insects of all kinds in check by spraying the plants on which they feed with arsenate of lead.

Look out for Irish blight in potatoes and tomatoes, and mildew on melons and kindred plants. Use Bordeaux or Burgundy mixture for the former, and finely ground sulphur or a sulphide spray for the latter.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

EARLY ripening apples, plums, apricots, peaches, and nectarines will be ready for marketing during the month. They are unsatisfactory lines to handle, as the old saw, "Early ripe, early rotten," applies to all of them; in fact, the season of any particular variety is so short that it must be marketed and consumed as quickly as possible. All early ripening deciduous fruits are poor carriers and bad keepers, as their flesh is soft and watery, deficient in firmness and sugar, and cannot, therefore, be sent to any distant market. The available markets are quickly over-supplied with this class of fruit, and a glut takes place in consequence. Merchants frequently make the serious mistake of trying to hold such fruits, in the hope of the market improving, with the result that, instead of improving, the market frequently becomes more and more congested, and held-over lines have to be sent to the tip. There is only one way to deal with this class of fruit, and that is to clear the markets daily, no matter what the price, and get it distributed and into consumption as rapidly as possible by means of barrowmen and hawkers. Most early ripening fruits are useless for preserving in any way, their only value being what they will bring for consumption whilst fresh. This being so, it is only a waste of time and money to forward immature, undersized, and inferior fruit to market, as it is not wanted, and there is no sale for it. It should never have been grown, as it is frequently only an expense to the producer, besides which, unless the fallen or over-ripe fruit is regularly and systematically gathered and destroyed in the orchard, it becomes a breeding ground for fruit fly and codlin moth, as well as of fungi, such as those producing the brown and ripe rots. Early ripening fruits should, therefore, be carefully graded for size and quality, handled, and packed with great care, and nothing but choice fruit sent to market. If this is done, a good price will be secured, but if the whole crop—good, bad, and indifferent—is rushed on to the local markets, a serious congestion is bound to take place and large quantities will go to waste.

Orchards and vineyards must be kept in a state of perfect tilth, especially if the weather is dry, so as to retain the moisture necessary for the development of the later ripening fruits. Where citrus fruits are grown, an irrigation should be given during the month if water is available for this purpose, excepting, of course, there is a good fall of rain sufficient to provide an ample supply of moisture.

Codlin moth and fruit fly must receive constant attention and be kept under control, otherwise the later-ripening fruits are likely to suffer severely from the depredations of these serious pests.

Grape vines must be carefully attended to and sprayed where necessary for black spot or downy mildew, or sulphured for oidium. Where brown rot makes its appearance, spraying with the potassium or sodium sulphide washes should be carried out. Leaf-eating insects of all kinds can be kept in check by spraying with arsenate of lead.

Farm Notes for December.

ALTHOUGH November is regarded generally as the best period for planting the main maize crop, on account of the tasseling period harmonising later on with the summer rains, December planting may be carried out in districts where early frosts are not prevalent, provided a known quick maturing variety of maize is sown.

To ensure a supply of late autumn and winter feed, dairymen are advised to make successive sowings of maize and sorghums, to be ultimately used either as green feed or in the form of ensilage. The necessity for such provision cannot be too strongly urged. Farmers who have not had any experience in building an ensilage stack can rest assured that, if they produce a crop for this purpose, information and instruction on the matter will be given on application to the Under Secretary for Agriculture and Stock; also that, whenever possible, the services of an instructor will be made available for carrying out a demonstration in ensilage-making for the benefit of the farmer concerned and his immediate neighbours.

In districts and localities where supplies of lucerne are not available, sowings of cowpeas should be made, particularly by dairymen, as the lack of protein-yielding foods for milch cows is a common cause of diminished milk supplies and of unthriftiness of animals in dairy herds. Cowpeas and lucerne can be depended upon to supply the deficiency. The former crop is hardy and drought-resisting. When plants are to be used as fodder, it is customary to commence to feed them to stock when the pods have formed. Animals are not fond of cowpeas in a fresh, green state; consequently the plants should be cut a day or two before use. Economy is effected by chaffing beforehand, but the plants can also be fed whole. Chaffed in the manner indicated, and fed in conjunction with green maize, or sorghum, when in head, in the proportion of one-third of the former to two-thirds of the latter, a well-balanced ration is obtainable. Animals with access to grass land will consume from 40 to 50 lb. per head per day; a good increase in the milk flow is promoted by this succulent diet. The plant has other excellent attributes as a soil renovator. Pig-raisers will find it invaluable also.

A great variety of quick-growing catch crops, suitable for green fodder and ensilage purposes, may also be sown this month, notably Sudan grass, white panicum, giant panicum (liberty millet), Japanese millet, red and white French millet. Well prepared land, however, is required for crops of this description, which make their growth within a very limited period of time. French millet is particularly valuable as a birdseed crop, the white variety being more in favour for this purpose.

Successive sowings may be made of pumpkins, melons, and plants of this description.

In districts where onions are grown, these will now be ready for harvesting. If attention is given, in the case of garden plots, to bending over the tops of the onions, maturity of the crop is hastened. Evidence will be shown of the natural ripening-off process, and steps should be taken to lift the bulbs and to place them in windrows until the tops are dry enough to twist off. If a ready market is not available, and it is decided to hold over the onions for a time, special care should be taken in handling. Storage in racks in a cool barn is necessary; otherwise considerable deterioration is to be expected. Improved prices are to be looked for in marketing by grading and classifying produce of this description.

Cotton areas which were subjected to a thorough initial preparation, thereby conserving a sufficiency of moisture for the young plants, should now be making good headway and sending their taproots well down. Keep down all weed growth by scarifying as long as the growth will admit of horse work.

CLIMATOLOGICAL TABLE—SEPTEMBER, 1932.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Atmospheric Pressure Mean at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.				Total.	Wet Days.
		Max.	Min.	Max.	Min.	Max.	Min.		
	In.	Deg.	Deg.	Deg.	Date.	Deg.	Date.	Points.	
Coastal.									
Cooktown	30·01	82	68	87	20, 25	59	13	27	2
Herberton	..	77	51	88	24	41	18	12	3
Rockhampton	30·04	83	59	92	22	51	11	63	6
Brisbane	30·08	74	54	82	13	47	10	300	12
Darling Downs.									
Dalby	30·06	75	46	83	14	35	1	156	7
Stanthorpe	..	66	39	75	14	25	10	228	10
Toowoomba	..	68	45	75	13, 14, 5	34	10	301	12
Mid-interior.									
Georgetown	29·96	89	57	96	24	43	17	Nil	..
Longreach	30·01	84	53	91	20, 28	43	1	8	2
Mitchell	30·05	75	43	86	14	32	7	53	4
Western.									
Burketown	29·99	89	63	97	23, 26	54	16	Nil	..
Boulia	30·02	83	52	97	20	40	15	6	1
Thargomindah	30·04	77	51	88	14	40	1	3	1

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF SEPTEMBER, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING SEPTEMBER, 1932, AND 1931 FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Sep.	No. of Years' Records.	Sep., 1932.	Sep., 1931.		Sep.	No. of Years' Records.	Sep., 1932.	Sep., 1931
North Coast.	In.		In.	In.	*South Coast*—continued—	In.		In.	In.
Atherton	0·65	31	0·10	0·31	Nambour	2·51	36	3·00	2·03
Cairns	1·67	50	0·52	0·72	Nanango	1·81	50	1·64	2·67
Cardwell	1·52	60	0·07	0·65	Rockhampton ..	1·34	45	0·63	2·75
Cooktown	0·58	56	0·27	0·31	Woodford	2·18	45	2·32	1·81
Herberton	0·52	46	0·12	0·26					
Ingham	1·49	40	0·39	1·18					
Innisfail	3·52	51	0·56	2·02					
Mossman Mill ..	1·43	19	0·45	1·22	*Darling Downs.*				
Townsville	0·82	61	0	0·32					
					Dalby	1·68	62	1·56	1·47
Central Coast.					Emu Vale	1·72	36	3·13	1·10
					Jimbour	1·49	44	1·20	1·60
Ayr	1·42	45	0	0·27	Miles	1·34	47	1·09	0·53
Bowen	0·82	61	0·19	0·28	Stanthorpe ..	2·28	59	2·28	2·34
Charters Towers ..	0·82	50	0	4·13	Toowoomba ..	2·13	60	3·01	1·37
Mackay	1·58	61	0·71	0·97	Warwick	1·80	67	3·18	1·79
Proserpine	2·10	29	0·90	0·08					
St. Lawrence ..	1·31	61	0·47	5·05					
					Maranoa.				
South Coast.									
					Roma	1·42	58	0·65	0·32
Biggenden	1·53	33	0·99	1·35					
Bundaberg	1·63	49	0·98	0·83					
Brisbane	2·00	81	3·00	0·91	*State Farms, &c.*				
Caboolture	1·84	45	3·10	1·49					
Childers	1·82	37	2·08	2·15	Bungeworgorai ..	0·93	18	0·73	0·18
Crohamhurst ..	2·57	39	4·02	1·81	Gatton College ..	1·52	33	3·11	0·83
Esk	2·13	45	2·27	1·10	Gindie	1·04	33	0·10	1·17
Gayndah	1·56	61	1·00	1·16	Hermitage ..	1·47	26	2·89	1·32
Gympie	2·09	62	4·00	1·10	Kairi	0·63	18	..	0·25
Kilkivan	1·69	53	1·65	1·57	Mackay Sugar Experiment Station	1·47	35	0·76	0·52
Maryborough ..	1·90	60	2·95	0·75					

GEORGE E. BOND, Divisional Meteorologist.

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON, F.R.A.S., AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	November, 1932.		December, 1932.		MOONRISE. Nov., 1932.	Dec., 1932.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					a.m.	a.m.
1	5·6	6·6	4·51	6·31	6·43	7·39
2	5·5	6·7	4·51	6·31	7·45	8·44
3	5·4	6·8	4·51	6·32	8·52	9·49
4	5·3	6·8	4·52	6·33	9·55	10·51
5	5·2	6·9	4·52	6·33	11·0	11·47
					p.m.	p.m.
6	5·2	6·10	4·52	6·34	12·2	12·41
7	5·1	6·11	4·53	6·34	12·59	1·35
8	5·0	6·12	4·53	6·35	1·55	2·27
9	5·0	6·13	4·53	6·35	2·47	3·23
10	4·59	6·13	4·53	6·36	3·40	4·17
11	4·59	6·14	4·54	6·37	4·33	5·12
12	4·58	6·15	4·54	6·37	5·27	6·7
13	4·58	6·16	4·54	6·38	6·23	7·0
14	4·57	6·16	4·54	6·38	7·17	7·53
15	4·57	6·17	4·54	6·39	8·12	8·41
16	4·56	6·18	4·55	6·39	9·4	9·25
17	4·56	6·19	4·55	6·40	9·55	10·3
18	4·56	6·20	4·56	6·41	10·42	10·35
19	4·55	6·21	4·56	6·41	11·28	11·7
20	4·55	6·22	4·57	6·42	12·0	11·39
21	4·55	6·23	4·57	6·43	..	..
					a.m.	a.m.
22	4·54	6·23	4·58	6·43	12·35	12·10
23	4·54	6·24	4·58	6·44	1·6	12·45
24	4·53	6·25	4·59	6·44	1·38	1·21
25	4·53	6·25	4·59	6·45	2·13	2·7
26	4·53	6·26	5·0	6·45	2·48	3·3
27	4·53	6·27	5·0	6·46	3·30	4·7
28	4·52	6·27	5·1	6·46	4·24	5·14
29	4·52	6·28	5·1	6·46	5·23	6·22
30	4·52	6·29	5·2	6·47	6·30	7·30
31	..	..	5·3	6·47	..	8·36

Phases of the Moon, Occulations, &c.

5 Nov.	☾ First Quarter	4	50 p.m.
13 ,,	○ Full Moon	5	28 p.m.
21 ,,	☽ Last Quarter	5	57 p.m.
28 ,,	● New Moon	10	43 a.m.

Apogee, 13th November at 8·6 p.m.
Perigee, 28th November at 12·36 a.m.

As Mercury will be at its greatest elongation, 22 degrees east of the Sun on the 14th, it will remain above the western horizon for more than an hour and a-half after sunset, for several days before and after that date, and should attract general attention.

On the 22nd, at 4 a.m., the Moon will be passing Mars, which will be only twice the diameter of the Moon to the northward.

The Sun having crossed the equator southward on 23rd September, will reach Cape York on 21st October, and again on 21st February, when returning northward. The clock time on 21st October will be 12·13 p.m., and on 21st February, 12·42 p.m. In November the Sun will be directly overhead at midday only as far south as a little below Mackay, Hughenden, and Cloncurry. , It will be over Cairns 8th November, over Townsville 18th November, Charters Towers 22nd November, Hughenden 27th November, and over Winton on 6th December.

The Moon's path amongst the stars in November will be in Orphiuscus on the 1st, in Sagittarius on the 2nd and 3rd, Capricornus 4th and 5th, Aquarius 6th and 7th, Pisces from the 8th to 11th, in Aries on the 12th, in Taurus from the 13th to 16th, in Gemini 17th and 18th, in Cancer 19th, in Leo from the 20th to 22nd, in Virgo from 23rd to 25th, Libra 26th and 27th, Orphiuscus 28th, and in Sagittarius on the 29th and 30th.

Mercury sets at 7.36 p.m. on 1st November and at 8·5 p.m. on the 15th.

Venus rises at 3.13 a.m. on 1st November and at 3·6 a.m. on the 15th.

Mars rises at 1.32 a.m. on 1st November and at 12·59 a.m. on the 15th.

Jupiter rises at 2·38 a.m. on the 1st and at 1·50 a.m. on the 15th.

Saturn rises at 10.36 a.m. and sets at midnight on 1st November, on the 15th it rises at 9.41 a.m. and sets at 11·9 p.m.

The Southern Cross will reach position XII. at 10 a.m. on 1st November, III. at 4 p.m., and will disappear in the south-west early in the evening; it will therefore be very little seen during this month.

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5 Dec.	☾ First Quarter	7	45 a.m.
13 ,,	○ Full Moon	12	21 p.m.
21 ,,	☽ Last Quarter	6	22 a.m.
27 ,,	● New Moon	9	22 p.m.

Apogee, 10th December, at 10.12 p.m.
Perigee, 26th December, at 11.36 a.m.

Mercury when passing from east to west of the Sun on the 4th will miss a transit of the Sun's face by being more than a diameter of the Moon northward of it. On the 23rd Mercury will reach its greatest western elongation, 22 degrees.

For places west of Warwick and nearly in the same latitude, 28 degrees 23 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

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